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THE MARINE MAMMALS
IN THE
ANATOMICAL MUSEUM
OF THE
UNIVERSITY OF EDINBURGH



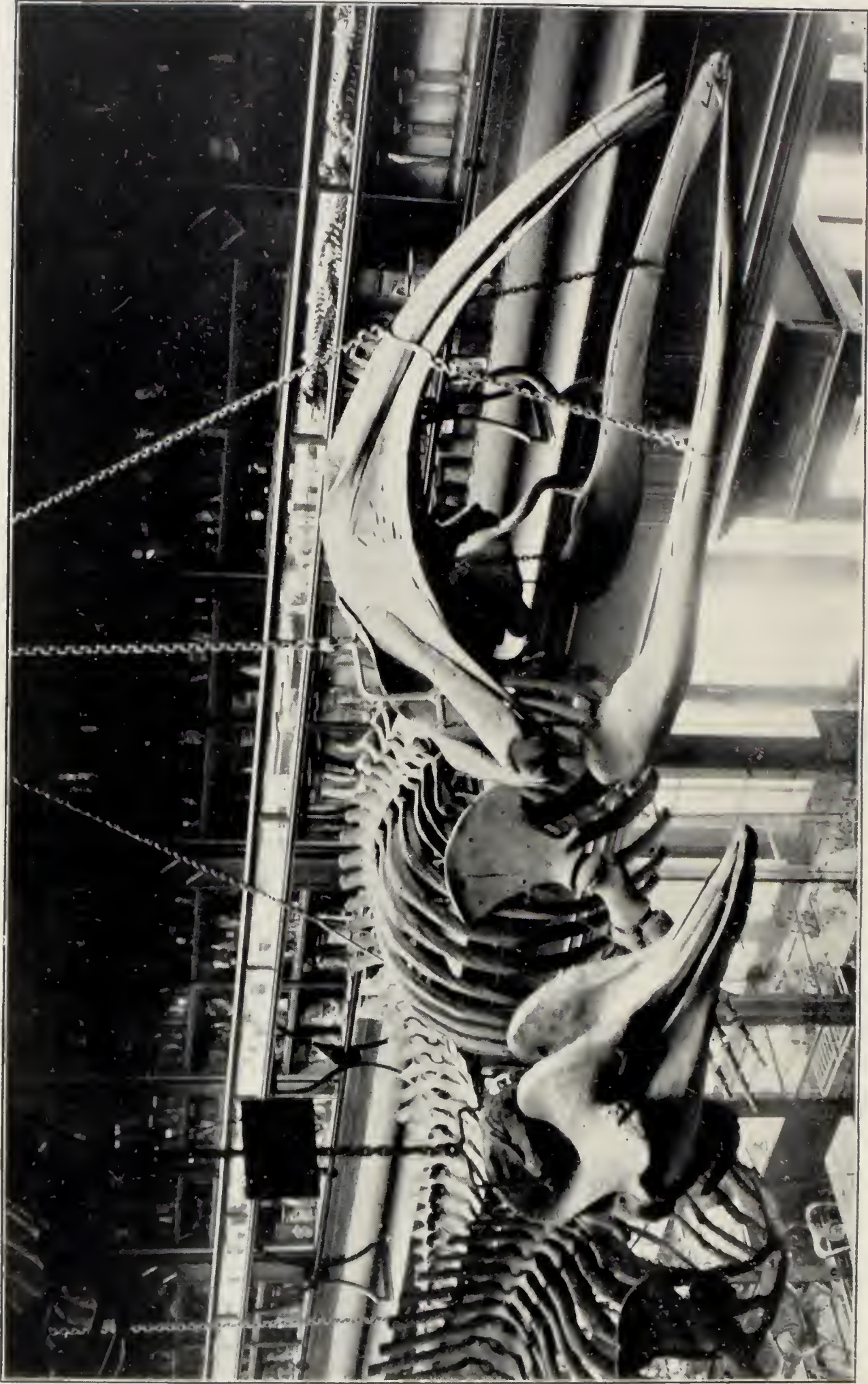
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Balena mysticetus.

Hyperoodon.

THE MARINE MAMMALS

IN THE

ANATOMICAL MUSEUM

OF THE

UNIVERSITY OF EDINBURGH

PART I.—CETACEA

PART II.—SIRENIA

PART III.—PINNIPEDIA

BY

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PRINCIPAL OF THE UNIVERSITY

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PREFACE.

THIS descriptive Catalogue of the Marine Mammals in the Anatomical Museum of the University has been compiled with the view of enabling a public, wider than that which can visit the Museum, to have the means of knowing the extent of the collection, and the opportunities which it affords for the study of the anatomy of these mammals. In the number and variety of species it ranks after the British Museum and the Museum of the Royal College of Surgeons of England, and is, I believe, third in the United Kingdom in the number of specimens of Cetacea and Pinnipedia which it contains; whilst, in species of Cetacea frequenting Scottish waters, it is larger and more complete than either of those important collections.

The Museum has acquired its examples of Cetacea mainly from the proximity of Edinburgh to the Firth of Forth and the North Sea, and the not infrequent opportunities occurring for the examination and preservation of specimens of whales stranded on the adjoining coast. Since the end of the seventeenth century, when Sir Robert Sibbald and Sir Andrew Balfour formed in Edinburgh their joint Museum, naturalists living in that city have availed themselves of these opportunities, and in the eighteenth and nineteenth centuries the capture of many specimens was recorded. Early in the nineteenth century Professor Robert Jameson, Dr John Barclay, and Dr Robert Knox preserved in their Museums the skulls and skeletons of various species which they had

examined. Since that time the Professors of Anatomy in the University, and other naturalists trained in the Edinburgh School, of whom I may especially name Sir John Struthers, have published descriptions and have made collections which have contributed to the growth of the Anatomical Museum.

The Museum is also much indebted to the late Professor Sir Wyville Thomson and to Sir John Murray for a collection of skulls and skeletons of Cetacea and Pinnipedia brought home by H.M.S. *Challenger*, which have been described in the Zoological Reports of the Expedition. More recently Dr Wm. S. Bruce has generously presented skeletons of the Pinnipedia which he had collected during the voyage of the *Scotia* in the Antarctic Ocean, examples of which had not previously been in the Museum. Students and young medical graduates of the University who have from time to time taken part in whaling voyages to the Arctic Ocean, more especially Dr Robert Gray, have also contributed specimens of Cetacea and Pinnipedia from that region.

Preliminary to writing the description of the osteological section I consulted Professor Robinson, the Conservator of the Museum, and with his approval I arranged with Dr T. B. Johnston, one of the Demonstrators of Anatomy on his staff, to draw up a card list, in which the nature of the specimen and the species and genus to which it belonged were to be noted. I desire to express my indebtedness to Dr Johnston for the assiduity and care which he gave to the execution of this part of the work. In the description of the bones I have availed myself, so far as seemed necessary, of the details recorded in my published papers, and it may be stated that the account of the skeleton of *Balenoptera sibbaldi* has been drawn up from notes made during my dissection of this animal more than forty years ago, and not previously published.

As regards the specimens illustrative of the soft parts, which with few exceptions are preserved wet, the descriptions

of the preparations made by Professor John Goodsir have been taken from a manuscript catalogue written under his supervision. In drawing up the description of those added by myself I have, as with the bones, made use of my printed papers and of notes not previously published.

In selecting from the extensive literature of the subject generic and specific names for the Cetacea, Sir Wm. H. Flower's Catalogue of the specimens in the British Museum, 1885, has been taken as the guide. His classification of all the Baleen Whales in a single family Balænidæ has not, however, been adopted, as the structural characters which collectively distinguish the Right Whales from the Rorquals are so numerous and important as to justify a division into the two families Balænidæ and Balænopteridæ.

In the classification of the Pinnipedia the generic and specific divisions adopted in my *Challenger Report*, 1887, on these mammals have been followed in the Catalogue.

The description of the specimens in each part, for each family, genus, and species respectively, has been preceded by a brief statement of the distinguishing characters, so that the Catalogue can be used by the student as a handbook or guide in discriminating the families, genera, and species to which they belong.

The illustrations are in some cases from the blocks employed in my published memoirs referred to in the text, but the majority have been specially prepared for the Catalogue, either from photographs or from original drawings of the objects. I wish particularly to thank Mr Ernest J. Henderson, the Assistant Conservator, for many photographs, especially those of the skeletons suspended in the Museum reproduced in Plates I., V., VI., and for the help which he has given in making the measurements detailed in the Catalogue. To Mr James T. Murray I am indebted for many careful drawings, more especially of the series of tympanic bones, which will be of service in the study of their modifications in form in the

several species, and in determining their value as furnishing specific characters. The drawings have been reproduced as process blocks by David Stevenson & Co. I wish also to express my thanks to the authorities of the Public Museum, Dundee, of the Museum of Zoology, Cambridge, of the Museum of the Royal College of Surgeons, England, for permitting me to obtain drawings of three tympanic bones, examples of which are not in the Anatomical Museum; also to the authorities of the Royal Scottish Museum, Edinburgh, and of the Smith Institute, Stirling, for permission to examine specimens in their collections.

I refer also with pleasure to the grant of money, by the Executive Committee of the Carnegie Trust, towards the cataloguing of the Museum, which has made it possible to produce this illustrated volume.

WM. TURNER.

UNIVERSITY, EDINBURGH, 1912.

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PART I.

ORDER CETACEA.

(CETE., C.)

WHALES AND DOLPHINS.

INTRODUCTION.

SCOTLAND, from its position between the North Sea and the Atlantic, and through the great firths or estuaries which penetrate inland for many miles, is favourably situated for the study of the CETACEA. The Orkney and Shetland groups of islands to the north, and the Hebridean islands to the west of the mainland, with their bays and intervening straits and channels, add largely to the coast-line. The Cetacea, in their migrations at some seasons to the north, at others to the south, not infrequently become stranded, and their capture gives opportunities to Naturalists to determine the Species and to become acquainted with their Anatomy.

Ample evidence exists that, in Prehistoric times, before the land and the sea had assumed their present level, whales, sometimes of great dimensions, had been stranded both on the east and west coasts.

As portions of the skeletons of some of these animals are in the Anatomical Museum, it may be of interest to relate the conditions under which bones of the prehistoric whales have been found.

From time to time specimens have been exposed in the banks of the Irvine river, Ayrshire, not far from the town of Irvine. The Rev. D. Landsborough stated that in 1790 some bones were found in the bank of the river where a new channel had been formed. In 1863 a further discovery of a portion of the skeleton of a whale was made in the river bank about a mile from the town, and the same distance from the sea. The bed of the river at the spot was said to be about 25 feet above sea-level. Some of the bones were removed and presented to the Glasgow University Hunterian Museum. In 1892 another series of bones was exposed, about 250 paces from the spot where the skeleton was found in 1863. One of large size was a part of the skull, and it was said to have rested on a bed of shingle stones and gravel, immediately below which was a thin layer of peaty-looking substance from half an inch to 2 inches in thickness. The skull bone is preserved in a museum in Kilmarnock. From its size and character the skull was probably that of a Balænoptera. Mr John Smith, in a description of the geological position of the Irvine Whale Bed, stated that he saw the specimen *in situ* lying in a darkish sand about 3 feet above the water of the river, and perhaps 10 feet

above the level of high water. The skull appeared to be in the same bed as that in which the bones were found in 1863, and the bed belonged to his group of forty-foot Beach Beds, in which layers of peat occur, and numerous organic remains, including those of horses and whales, have been found (*Trans. Geol. Soc. Glasgow*, vol. x., 1896).

In 1823 Sir G. S. Mackenzie of Coul communicated to the Royal Society of Edinburgh (*Transactions*, vol. x.) an account of the vertebra of a whale exposed in a bed of bluish clay near Dingwall, in Ross-shire, in a raised beach about three miles from the sea and about 12 feet above high-water mark. No attempt apparently was made to discriminate the species of whale to which the vertebra belonged.

The part of Scotland which has given the most abundant evidence of the presence of skeletons of whales in raised sea-beaches is the valley of the Forth, more especially in the precincts of Stirling. The recorded examples have been summarised from time to time by the Rev. Charles Rogers in his guide-book to the Bridge of Allan, by Mr David Milne Home in his *Ancient Water-Lines in Scotland* (1882), and recently and more fully by Mr David B. Morris, in *The Raised Beaches of the Forth Valley* (1892, reprinted 1901). Mr Morris has collected not fewer than fourteen records of bones of whales exposed in the fifty-foot raised beach bordering the river Forth and the upper end of the Estuary. They were imbedded in the Carse blue clay subjacent to the soil now worked in agriculture, and were met with either in making roads or drains, or in digging the clay for the manufacture of bricks. The clay frequently contains shells of various species of molluscs, foraminifera, etc., now inhabiting the adjoining sea, and the whales' bones usually occur from 20 to 30 feet above the present high-water level.

The earliest and most complete discovery was at Airthrey, near Stirling, in July 1819, of the skeleton of a whale, the length of which was roughly estimated at about 72 feet. The bones were lying in blue silt at a depth of between 4 and 5 feet from the surface of the ground, and 24 feet above high-water level of the river Forth. An account of the discovery was given in the *Edinburgh Philosophical Journal*, vol. i., by Mr Robert Bald. In a letter in my possession, written on 20th August 1819 by Mr Bald to the Rev. Dr Baird, the Principal of the University, it is stated that on the previous day the bones were dispatched by steamer to be deposited in the University as most interesting specimens of natural history. The letter contained an inventory of the bones, as follows: head bone, jaw bones, forty vertebræ, thirteen ribs, one shoulder-blade, swimming paws, various broken bones, an ear bone, deer horns, one of which was stated in Mr Bald's paper in the *Philosophical Journal* to have been perforated. The bones were placed in the Natural History Museum, then under the charge of Professor Rt. Jameson, which was transferred in 1856 to the Science and Art Department, and formed the nucleus of the Natural History Collection in the Museum, now known as the Royal Scottish Museum.

In the catalogue of a museum formed in Stirling during the first half of the last century by the late Mr John Macfarlane, afterwards transferred to the Smith Institute, is an entry, "Part of a whale's skeleton found at Airthrey," which leads one to think that some of the bones had been received there, though they cannot now be identified.

In 1823 the workmen employed in deepening a drain in Dunmore Park exposed in the stiff clay subsoil a number of large bones of a whale. Mr Blackadder and Mr Keddoch stated in the *Edinburgh New Philosophical Journal*, vol. xi., 1824, that they were about 2 feet from the surface, and from 23 to 24 feet higher than tidal high-water mark. The bones were chiefly vertebræ, and were presented to Professor Jameson for his Museum. It would appear from the *New Statistical Account of Scotland*, vol. viii., 1842, that whales' bones had been also found in 1817 to the north of the mansion-house of Dunmore, upwards of a quarter of a mile from the river bank.

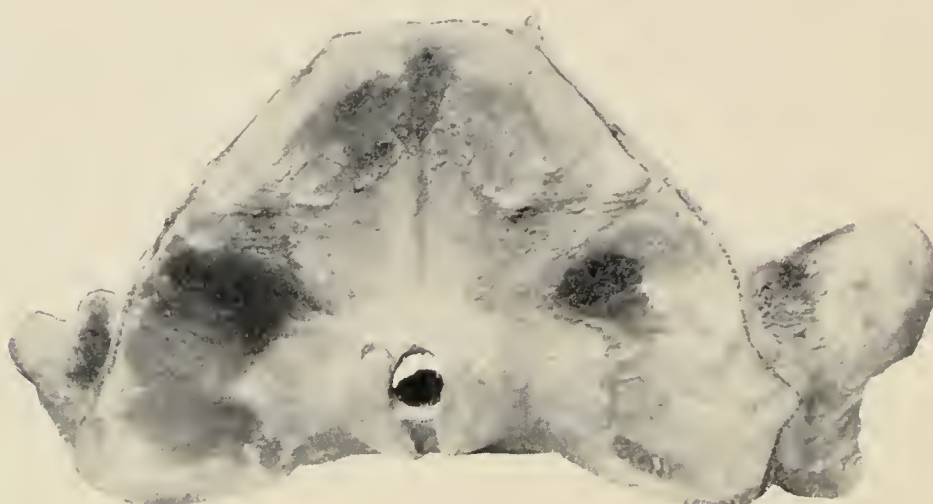
In October 1824 bones of a whale were exposed in Burnbank, on the Blair Drummond estate, seven miles west from Airthrey, and twelve miles from Dunmore. They were imbedded at a depth of 4 feet in the Carse clay, nearly a mile from the river Forth, and within 400 yards of the boundary where the clay ends (Mr Home Drummond and Mr Blackadder in *Mem. Wernerian Soc.*, v., 1826). The bones recognised were a large portion of the cranium, comprising the occipital, frontal, and a part of the superior maxilla, also a scapula and several vertebræ in a mutilated state. A part of a stag's horn, perforated like that found with the Airthrey whale, accompanied the bones, and the objects were presented to the Museum of the University.

Distinct records therefore exist that portions of the skeletons of whales from three localities in the Carse of Stirling were presented to the Natural History Museum between the years 1819 and 1824. No catalogue of the fossilised bones seems to have been in existence at the time when the University Collection was transferred to the Museum of the Science and Art Department.

It is, however, fortunate that the head bone specified in the inventory in Mr Bald's letter preserves a label, "Airthrey Fossil Whale," which identifies it as from that animal, and from it we can form an idea of the magnitude of this whale. The specimen consisted of the occipital bone, with its condyls and the foramen magnum, together with the adjoining portions of the temporals. The large supra-occipital sloped upwards and forwards. Its posterior surface was slightly concave; it had in the mesial line a low ridge, and it is ridged also on each side (figure, p. 6).

At each side of the occipital a massive squamoso-zygomatic temporal projected outwards for 2 feet 2 inches, and added materially to the breadth in the temporo-occipital region. I have compared the diameters with the corresponding bones of the Longniddry *B. sibbaldi* and of *B. musculus*:—

	Airthrey Whale.		Longniddry <i>B. sibbaldi</i> . Bpt. s. 3a.		<i>B. musculus</i> . Bpt. m. 1.	
	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
Foramen magnum to vertex of occipital	3	5½	3	6	1	11
Greatest breadth of occipital	5	8½	6	0	2	11
Temporo-occipital breadth	9	6	10	1	4	8½
Breadth of condyl	0	7½	0	8		
Antero-posterior of condyl	1	3¼	1	1		



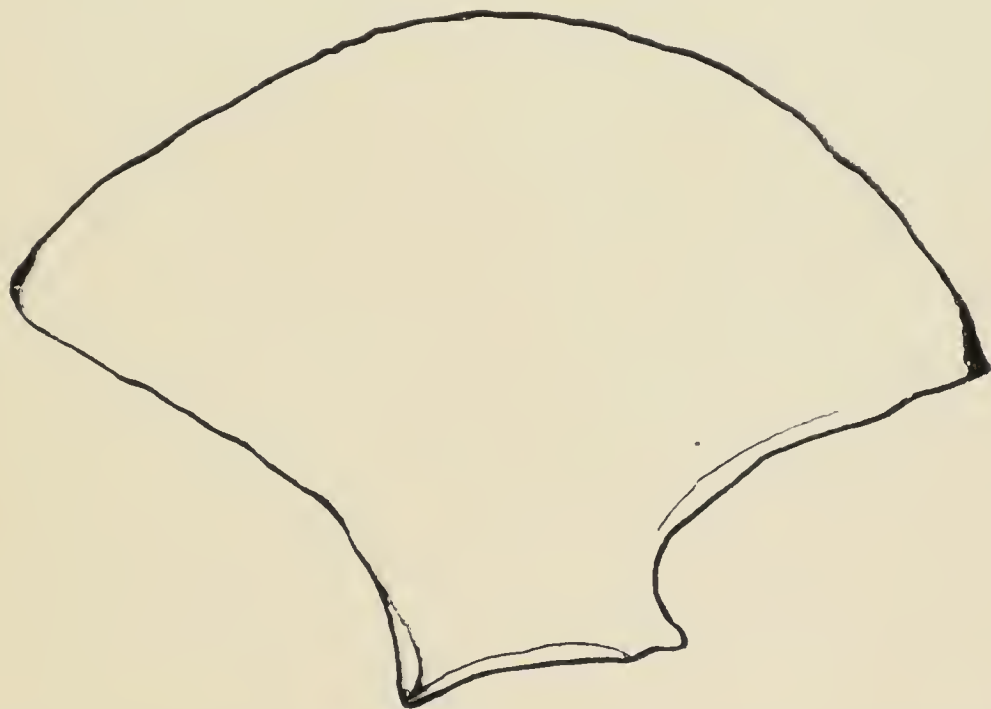
The Airthrey and Longniddry whales corresponded closely in these dimensions, and as the latter was nearly 79 feet long, Mr Bald's estimate of 72 feet scarcely perhaps gives the full length of the Airthrey specimen. Both animals much exceeded the dimensions of *B. musculus*.

The condyls of the Airthrey skull were separated in front by a groove 2 inches wide, whilst behind they were 4½ inches asunder. The foramen magnum was almost a circle, and measured 5½ by 5½ inches. The vertex border of the bone was not pointed, but had a convex curve 18½ inches long.

One lumbar vertebra had been retained in the Royal Scottish Museum, a massive bone, 3 ft. high and 3 ft. 5 in. between the tips of the transverse processes; the spine was 1 ft. 10 in. long, the body 15 in. by 12 in. It resembled the lumbar vertebræ of the Longniddry *B. sibbaldi*. Eight ribs were still preserved in the Museum. One, a second rib with a distinct capitular process, measured 8 feet 4 inches along the curve from the articular tubercle to the opposite end, whilst the chord of the arc was 6 feet. Another was 9 feet 5½ inches along the curve; the chord was 7 feet 6½ inches. Another, though somewhat broken at one end, was 9 feet 7 inches along the curve; it had been fractured near one end during life, as Mr Bald had noted, but had become repaired, and was thickened at the place of fracture. The shortest rib, evidently one of, if not the hindmost, was 5 feet 5½ inches along the curve, and the chord was 4 feet 1 inch. From

the magnitude of the bones and from the close correspondence of the occipital region with that of the Longniddry whale, I believe that the Airthrey specimen should also be regarded as *Balænoptera sibbaldi*.

In addition to the bones now described, but not having a label or other mark of identification, is a right scapula which in general appearance and texture resembles the bones found in the Carse clay. Its length between the two angles was 5 feet 2 inches, and the glenoido-vertebral diameter was 3 feet 5 inches. It was an unusually thick plate for a scapula, $2\frac{3}{4}$ inches at the superior angle, $2\frac{1}{4}$ inches at the inferior angle; the vertebral border, forming a continuous convex curve, was $1\frac{1}{2}$ inch thick. The long diameter of the glenoid fossa was 15 inches. The coracoid process was represented by a rough tubercle with a base of 2 inches; no acromion was present; the dorsal



spine was only faintly indicated. The scapula (figure above) differed materially from that of *B. sibbaldi*, in which, as can be seen in Plate IV., the bone is triangular, the vertebral border is moderately convex, the spine is distinctly marked, the acromion and coracoid are large processes, and the blade is relatively thin. The Carse scapula corresponds, in its general form and in the absence of processes, with the description and figures given of this bone in *Megaptera boops*. The longest *Megaptera* yet recorded was $51\frac{1}{2}$ feet (True, *Whale-bone Whales of the North Atlantic*, 1904), but the customary length is between 40 and 50 feet. In the Tay specimen described by Sir John Struthers, the ossification of which was not completed, the length was 40 feet.

In the absence of any history of this scapula, one can only speculate on its origin. There is no evidence that it was found at Airthrey, and there is reason to regard the skeleton from that locality as a

B. sibbaldi, a whale which far exceeds the dimensions of Megaptera. But two other localities in the Carse also contributed bones to the old Natural History Museum, and amongst those sent from Blair Drummond a scapula is definitely named. Granting, as its appearance indicates, that the bone had been a part of the skeleton of a Carse whale, the interest centres on this rather than on the particular skeleton of which it had been a part, for it proves that in prehistoric times the Hump-backed Whale had frequented the great estuary of the Forth, a fact which had not previously been recognised.

Mr Milne Home stated in his work, *The Estuary of the Forth*, that in 1859 bones of a whale were found in Christie's brickfield, Stirling, but no details were given. In 1863, in the same field, called Cow Park, which lies in a loop of the river Forth, about 200 yards from the new bridge at Stirling, a large part of a skeleton was exposed. I was told by Provost Christie that the bones were imbedded in the blue clay, 13 to 14 feet below the surface of the ground, and from 3 to 4 feet above the level of high water. They were given to the Corporation of Stirling, who some years afterwards presented them to the Anatomical Museum of the University. They were much broken, but I have succeeded in piecing together fragments of the skull and of the mandible, to permit some measurements to be made and to partially restore their form (Catalogue, p. 68). Several ribs were obtained, usually broken, one of which, with its two-headed vertebral end, is described and figured, p. 69; also a number of vertebræ, much injured, which belonged to the several groups. In the Smith Institute, Stirling, is a rib 5 feet long in the arc and 45 inches in the chord, marked as found in this brickwork, 1863; and not unlikely some other ribs, one of which is 6 feet $5\frac{1}{2}$ inches long in the arc, 5 feet $1\frac{1}{4}$ inch in the chord, though not marked, are from the same animal. The Catalogue of this Institution also contains an entry: "Vertebræ of skeleton of a whale found in Christie's brickfield, Cow Park."

In 1864 a portion of the skeleton of a whale was exposed in a brickfield at Cornton, situated between Stirling and the Bridge of Allan. It was about 9 feet from the surface, in clay, in which Mr Haswell determined the presence of shells of oyster, mussel, cockle, and whelk, also a Trophon and a Balanus, with fragments of bark, hazel nuts, and the fibres of marsh plants. The bones were lying about 30 feet above the present sea-level, and the skull, in a fragmentary state, along with the ear bones, was given to a museum in Glasgow. The tympanic was $4\frac{1}{2}$ inches long, $2\frac{1}{2}$ inches broad, $2\frac{3}{4}$ inches high. The periotic was fused with it, also an elongated mastoid. Its characters were those of Balænoptera, and it was apparently a young *B. musculus*.

In April 1877, whilst a drain was being dug at Woodyet, Meiklewood, Gargunnoch, about six miles west of Stirling, some vertebræ of a whale were seen in the clay subsoil. The excavations were resumed in September, and a skull, more vertebræ with the plates

not fused with the bodies, and some ribs were brought into view. They were about 100 yards from the river Forth, which bounded one side of the field, and they were estimated to be about 30 feet above high-water level. I visited the place when the excavations were in progress; the vertebræ were not in serial order, but were lying irregularly in the clay, turned over on their sides, and the skull was at the west of the spine. The bones were removed to the lawn at the mansion-house, where I again saw them and counted two dorsal, seven lumbar and one cervical vertebræ, the pair of 1st ribs, a part of another rib, and the hinder part of the skull. The right side of the occipital bone was injured, but the left side and the condyls were present; the basi-occipital was jointed but not fused with the post-sphenoid, with which the base of the vomer was articulated; parts of the temporal bones were present, and on one side the periotic was *in situ*. I measured the largest, most perfect lumbar vertebra, 26 inches from the ventral surface to the tip of the spine and 30 inches between the transverse processes; the body was $10\frac{1}{4}$ inches in dorsi-ventral and $12\frac{1}{2}$ inches in transverse diameter. The left 1st rib was almost entire, but the right one was broken. The body of a cervical, that of a lumbar, and the tympanic bones are described on p. 69 of the Catalogue of the Anatomical Museum.

The bones were retained for a time at Meiklewood, and were subsequently presented by Mrs Dalrymple to the Smith Institute. The collection consists of the occipito-temporal region of the skull; the 1st dorsal vertebra, $23\frac{1}{2}$ inches between tips of transverse processes, with the body $7\frac{1}{4}$ inches transversely and $5\frac{1}{2}$ inches dorsi-ventrally; a 1st left rib 56 inches long on the arc and $23\frac{1}{2}$ inches in the chord, some broken vertebræ, and plates and portions of ribs. An atlas vertebra, the anterior articular surface of which measures 14 by $7\frac{3}{4}$ inches, may also belong to this animal.

The implement of deer's horn lying beside the skull was obviously similar to those found along with the skeleton of the Airthrey Whale and with that subsequently exposed at Blair Drummond. It was at one time customary to call them harpoons or lances, but their shape, without a point, and the position of a hole for a handle in the middle and not at one end of the implement, unfit them for the purpose of a harpoon or lance. The chisel-shaped end, again, adapts them for dividing the blubber, and it is probable that the neolithic people descended from the adjoining heights and used them to remove the blubber from the carcase of the stranded whale (figure, p. 70).

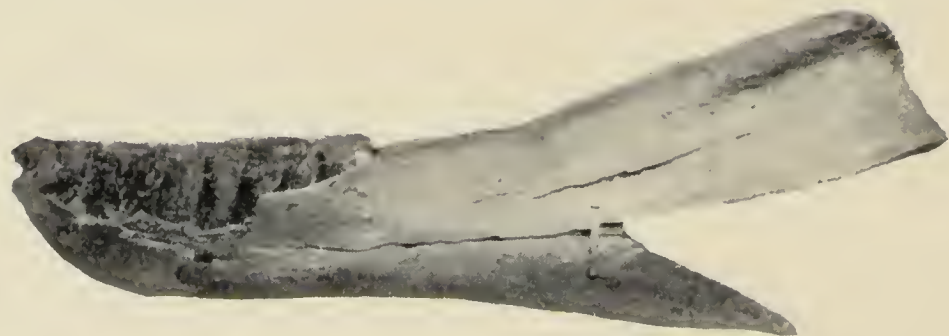
In the Smith Institute is a scapula, which unfortunately bears no mark of locality, though there can be no doubt, from its appearance, that it was from the Carse clay. Possibly it may have been in the Macfarlane Collection already referred to. Its diameters were: between anterior and posterior angles, $34\frac{1}{2}$ inches; glenoido-vertebral, $33\frac{1}{2}$ inches. The vertebral border was convex and thick; both the coracoid and acromion processes were absent. The scapula therefore

had the characters of a Megaptera, and it provides another example, though smaller in size, to that already described on page 7.

Notices of the Carse whales above described are included in Mr Morris's narrative, but in addition he refers to the remains of one found at Woodlane, Blair Drummond; to another at West Carse, on the Touch estate; to a third in a brickfield near Falkirk, about three miles from the sea; to two whales found at Dunmore in 1846 and 1857; also to a vertebra in the neighbourhood of Grangemouth, in a bed of clay 9 feet from the surface and 12 feet above high-water mark, in which Mr John Burns recognised shells of *Cardium*, *Littorina*, *Ostrea*, *Buccinum*, also a few of *Tellina proxima* and *Trophon scalariforme*.

In the reprint of *The Raised Beaches of the Forth Valley*, 1901, Mr Morris related the discovery in 1897 of portions of ribs of a whale whilst digging a drain from the village of Causewayhead, Stirling, to the river Forth. They were lying in the clay close to where it joined the old coast-line of the fifty-feet raised beach. Mr Morris asked me to examine the remains, and I observed that the end of one rib was cleft into the cancellated tissue, and its sides were formed by the outer and inner surfaces of the bone. The condition was not natural, and seemed as if it had been artificially shaped by the hand of man. A short distance from the ribs a part of the beam, with one of the tines, of the antler of a red deer was found. The surface of the beam and tine was not roughened, but smooth as if from use; and as the tine was pointed, it had the appearance of having been employed as an implement for boring.

In the process of excavating in 1903 for a new dock at Grangemouth, near the point where the river Carron debouches on the estuary of the Forth, numerous bones were found about 30 feet below the present surface, in the same horizon. Mr Donald D. Arbuthnott, the engineer in charge, wrote: "The superjacent material consisted of 5 to 6 feet of sand, a considerable thickness of mud (watery clay),



then a bed of gravel, on which the bones were lying, 2 to 3 feet thick, composed of roundish boulders, some of considerable size, bedded in clay. The gravel bed covered a large area and dipped to the Forth." Specimens were preserved, and were presented through Mr Morris to the Smith Institute. I have had the opportunity of examining them. The specimen which is of most interest in the present

inquiry is the left mandible of a whale with sockets for large teeth. From a comparison of the mandible with the jaws of the Odontoceti in the Anatomical Museum, it is from an *Orca gladiator*. Though injured at the tip of the symphysis and at the condylar end, its length was 32 inches, and the empty sockets for eleven teeth were at the symphysial end. As the outer wall of the sockets was broken away, their cavities were exposed. The largest socket was $3\frac{1}{2}$ inches deep, and $1\frac{1}{4}$ inch in antero-posterior diameter. The symphysis was rough, $7\frac{5}{8}$ inches long and $2\frac{3}{4}$ inches broad. The mandible behind the last socket was 11 inches in vertical diameter (figure, p. 10). This is the first locality from which fossilised remains of the Killer Whale (*Orca*) have been recognised in Scotland.

Professor Cossar Ewart has carefully examined the other mammalian remains from the same spot and has named them—two skulls of broad-browed ponies of the forest type; skull of a ram of the peat or turf type (*Ovis palustris*); skull of a dog in size resembling a greyhound; and an imperfect antler like that of a reindeer.

The first naturalist to write a detailed account of the large whales which frequent the Scottish seas in modern times was Sir Robert Sibbald, one of the founders of the Royal College of Physicians, Edinburgh, and author of works on local history, geography, and natural objects. He published in 1692, with illustrations, a volume entitled *Phalainologia Nova, sive Observationes de Balænis in Scotiæ littus nuper ejectis*. In it he gave an excellent account of a Rorqual, 78 feet long, a male, stranded in September 1692, near the castle of Abercorn, on the Firth of Forth. The configuration and dimensions of the head and body and the black colour of the baleen plates and bristles were so precisely described that one readily recognises it as a typical specimen of the great whale which is now appropriately named Sibbald's Whale, *Balænoptera sibbaldi*.

Another Rorqual, a male, 46 feet long, was stranded in November 1690 to the west of Burntisland. Its length was proportioned to its girth, and its form was more slender than the Abercorn specimen. The head was slightly oblong, and the snout was midway between the acute and the obtuse. The baleen plates were not described. Its length exceeded *B. rostrata* and *B. borealis*. The upright dorsal fin and the short pectoral limb proved that it was not Megaptera; its more slender form and the shape of the beak showed it not to be *B. sibbaldi*, so that it was probably an immature *B. musculus*. A character was given by Sibbald which he regarded as peculiar, that the nares were not situated on the head, but in the beak 6 feet 8 inches from the extremity of the superior maxilla.

Sibbald recorded the stranding of a male Sperm Whale about 52 feet long, in February 1689, at Limekilns, on the Firth of Forth. Also a female on one of the Orkney Islands in 1687, the head of which was 8 or 9 feet high. Its length was not given. From the form of the head, the position of the blowhole, the arrangement of the teeth, and the spermaceti obtained from the head, this animal was

obviously also a Sperm Whale. In a manuscript addition to the copy of the *Phalainologia Nova* in the Library of the Royal College of Physicians, Edinburgh, are two figures of a Sperm Whale taken at Monifieth, February 23, 1703; they are believed to have been prepared for a new edition of the *Phalainologia* which was not published. Sibbald also gave an account of small whales, with teeth in both jaws, captured in 1690 and 1691 at Culross, Blackness, and Kirkcaldy. Some were 20 to 25 feet long, and he styled them Orcaæ. He also speaks of twenty-five small whales, which ranged from 10 to 12 feet in length, being cast ashore in 1690 on Cramond Island. Some may possibly have been of the genus which we now call Orca, others Globicephalus. Sibbald published in 1697, with the title *Auctarium Musæi Balfouriani e Musæo Sibbaldiano*, a catalogue of the specimens collected by Sir Andrew Balfour and himself. Fifteen of these were derived from the Whalebone Whales, the Sperm Whale, and the Orcas described in the *Phalainologia Nova*; they probably constituted the first cetological collection made in Scotland.

During the eighteenth century and the early years of the nineteenth the stranding and capture of occasional isolated specimens were recorded. Mr James Paterson, the keeper of the Balfourian Museum, stated that in 1701 a male Sperm Whale nearly 52 feet long "came in at Crawmond." In 1769 Mr James Robertson described a male Sperm Whale, 54 feet long, also stranded on Cramond Island. In 1756 another was said to have come ashore on the west coast of Ross-shire.

Professor John Walker examined a Rorqual cast ashore at Burntisland in June 1761, the sex of which was not determined. It was 46 feet long; the pectoral limb was 5 feet long and 9 inches in greatest breadth; the tail was $11\frac{1}{2}$ feet in transverse diameter; the distance from the dorsal fin to the insertion of the tail was 10 feet 10 inches; the height of the falciform dorsal fin was 2 feet 10 inches, whilst at the root it measured 2 feet 7 inches; the longest baleen plates were 2 feet, their breadth was 6 inches, and they were said to be "nigra splendentæ" (*Proc. Soc. for Investigating Natural History*, Edinburgh, 1782, No. 13, p. 91). From the colour of the baleen, it was probably an immature *B. sibbaldi*.

Two White Whales were recorded as cast ashore in 1793, east of Thurso. One was killed in 1815 on the Forth near Stirling, and was described by Dr Barclay and Mr Patrick Neill. More recently, in 1845, one was stranded at Auskerry, one of the Orkneys. The discovery of the skull in 1800 near Brodie House, Moray Firth, by Mr Sowerby, gave us the first specimen of *Mesoplodon bidens*, or Sowerby's Whale. The Rev. Dr Fleming described in 1808 a Narwhal obtained at the Sound of Weesdale in Shetland; but Tulpius had recorded, so far back as 1648, the capture of a specimen near the Isle of May, at the entrance to the Forth. Dr Traill established in 1809 the frequent occurrence of the Pilot Whale, *Globicephalus melas*, in the Orkneys. In a volume of *Essays* on natural history, published in 1808, Professor Walker included

the Cetacea in his synopsis of the Mammalia Scotica, and in 1828 Dr John Fleming, in his *History of British Animals*, brought the classification and characters of the Mammalia up to the knowledge of that day.

A great step in advance was made when Dr Robert Knox and Mr Frederick J. Knox undertook the dissection of a Great Whale stranded at North Berwick in October 1831. The whale, a male, was 78 feet long, and was named by them the *Balæna maximus borealis* or Great Northern Rorqual with integumentary folds. It was fortunate that it came into the possession of so able a practical and scientific anatomist as Robert Knox, by whom the skeleton and many preparations in illustration of the anatomy of the soft parts were preserved, and a description of the animal was published. Specimens in illustration of the anatomy of other whales he also obtained: for example, the Piked Whale or *Balænoptera acuto-rostrata*, the Greenland or Right Whale, a Dolphin named *Delphinus tursio*, the Common Porpoise, and the Gangetic Dolphin. To these were added the skeleton and soft parts of the Dugong. The collection was arranged and exhibited as a Museum in Edinburgh, and a descriptive catalogue of the specimens was published by Mr Frederick J. Knox in 1838. It was unfortunate that, after being on view for some years, the collection had to be dispersed; but Professor John Goodsir, who was then actively engaged in developing the Anatomical Museum of the University, acquired a number of the specimens which are recorded in the present Catalogue. The skeleton of the Great Rorqual became the property of the City of Edinburgh, and after being exhibited for a number of years in a building in the now extinct Zoological Gardens, has found a permanent resting-place in the Royal Scottish Museum. Professor Goodsir added to the Anatomical Museum, from his own dissections, the skeleton and many soft parts of a Hyperoodon stranded in 1845 at Alloa (Catalogue, p. 81). He also prepared a number of dissections, many of which illustrated the growth of the baleen plates, from a Rorqual, about 35 feet long, probably *B. musculus*; and he procured from whaling captains the skull of a well-grown *B. mysticetus*, also the skeleton of a younger animal, which, as well as the skeleton of Hyperoodon, was not articulated until the collection was arranged by me in 1885 in the present Anatomical Museum of the University.

My studies of the Cetacea began in 1867 with the dissection of the Pilot Whale, *Globicephalus melas*, one of a school which visited the Firth of Forth in that year. My interest was intensified when in 1869 a Great Rorqual, *Balænoptera sibbaldi*, was stranded at Longniddry; the study of its anatomy occupied many months of my time, and enabled me to identify it as the same species as Knox's North Berwick Whale and Sibbald's Great Rorqual stranded near Abercorn in 1692. Since then I have enjoyed the opportunity of examining *Bpt. musculus*, *borealis*, and *rostrata*, Physeter, Ziphius, Hyperoodon, *Mesoplodon bidens* and *layardi*, Platanista, Monodon, Delphinapterus, Phocæna, Cephalorhynchus,

Orcella, Orca, Globicephalus, Grampus, *Lagenorhynchus albirostris* and *acutus*, Delphinus, Tursiops.

I have consequently been enabled, as will be seen in the Catalogue, to add a large number of specimens to the Museum, and I am indebted to many pupils and kind friends for help in procuring them. I may especially refer to the late Mr John Anderson of Hillswick, Shetland, and to his three sons, two of whom were my students and are now graduates of the University. In my studies on the Cetacea I have derived great assistance from the memoirs and systematic writings of Cuvier, Eschricht, Reinhardt, Sir Richard Owen, J. E. Gray, Van Beneden, Gervais, James Murie, Sir Wm. Flower, and more recently F. W. True.

Concurrently with my work on the Cetacea in Edinburgh, the late Sir John Struthers was conducting, during his occupancy of the anatomical chair in Aberdeen, important investigations into their anatomy. He published a series of detailed descriptions on the limbs and other parts of the Greenland Right Whale, on *Balænoptera musculus*, on a White Whale (Beluga) killed at Wick in 1884,¹ on Monodon, Globicephalus, and a valuable monograph on *Megaptera boops*. The University Museum is deeply indebted to him for a number of specimens which illustrate their anatomy, reference to which is made in the Catalogue.

The establishment, during the last few years, of whaling stations in Shetland, and at Harris in the Long Island, has led to the capture in Scottish and adjoining waters, in addition to *Bpt. sibbaldi* and *musculus*, of large whales which had previously been regarded as only occasional visitors. I would refer especially to a number of Sperm Whales, to *Balænoptera borealis*, and even to *Balæna biscayensis*, a species which for many years past was thought to be extinct, though now the trend of opinion is to regard it as the northern form of *Balæna australis*.

The Anatomical Museum contains examples of 22 genera and of 33 species of Cetacea, and of the species 21 were stranded on the coast, or otherwise captured in Scottish waters. Including the soft parts, the Collection consists of about five hundred specimens.

From the dimensions of the principal building of the Museum, it has been possible to suspend a number of articulated skeletons, even of the largest species. In the construction of the roof provision was made for the insertion of strong steel bars, from which skeletons have been suspended. As is customary in collections, many of the species are represented only by their skulls, on the differences in which naturalists are in the habit of relying in the study of specific and generic distinctions. In preparing the Catalogue I have paid special attention to the characters displayed by the following regions as

¹ Sir Wm. Flower recorded (*Proc. Zool. Soc.*, 1879) the capture of a Beluga near Dunrobin, Sutherland; and Professor Alex. Meek the capture, in June 1903, of a male, 14 feet 2 inches long, at the mouth of the river Tyne (*Trans. Nat. Hist. Soc. Northumberland*, New Series, vol. i.).

useful in classification: the fronto-naso-premaxillary; the maxillo-premaxillary rostrum, or beak; the hard palate and the pterygoids; the teeth, their absence, or presence, size, form, and numbers; and the tympano-periotic bones.

The Fronto-naso-premaxillary Region.—In the Baleen Whales this region is symmetrical. In the genus *Balæna* the nasals occupy the interval between the upper ends of the right and left premaxillæ, and are flattened and horizontal on the dorsal surface. In *Balænoptera musculus* the inner border is raised into a crest, the dorsum is grooved, and slopes gently downwards and forwards; in *B. sibbaldi* the nasals are large, dorsum convex slopes rapidly downwards and forwards, outer border is raised into a crest; in *B. borealis* the nasals are short, with a low mesial ridge, dorsum faintly concave from side to side, convex from behind forwards, sloping down in front; in *B. rostrata* the nasals are small, convex on dorsum, have no crest mesially or laterally, and dip rapidly down in front. In Megaptera the nasals are narrow, pointed, ridged mesially, concave laterally; an internasal fissure receives the nasal spine of the frontal, which appears on the surface between the two nasal bones. The nasal ends of the premaxillæ incline inwards and are bent with an inward convexity.

In *Physeter* the region shows an extreme degree of asymmetry. The upper end of the right premaxilla spreads upwards and to the left, and occupies the place of the right nasal; the left premaxilla does not reach the left nasal; the anterior nares are displaced, the right somewhat anterior to the left. The maxillæ and frontal are raised into a high crest which bounds the bowl-shaped chamber for the spermaceti.

In *Ziphius* the conjoined nasals and the premaxillæ are expanded and raised as asymmetrical eminences, which overhang like the eaves of a house the anterior nares; the right nasal and premaxilla are more expanded than the left.

In *Hyperoodon* the nasals are concave forward, the premaxillæ are expanded asymmetrically, and the anterior surface overhangs the nares; the striking specific character is the development of the maxillary crests, which are separated from the nasals by a deep cleft.

In *Mesoplodon* the nasals are vertical and locked in between the overhanging borders of the premaxillæ, which form rough ridges.

In *Platanista* the marked specific character is the pair of plate-like maxillary crests which curve inwards and almost meet above the middle of the face.

In the *Delphinidæ* the nasals do not form a roof for the narial opening, but are short nodular bones which lie behind the opening, and their long axes are almost vertical. The premaxillæ are at the sides of the nares and not quite symmetrical, for the left, as a rule, is shorter than the right. In *Monodon*, *Phocæna*, *Grampus*, *Lagenorhynchus*, and *Cephalorhynchus* the nasal end of the premaxilla is generally convex, or marked by a longitudinal ridge. In *Delphinapterus*, *Orcella*, *Orca*, *Globicephalus*, *Delphinus*, *Prodelphinus*, and *Tursiops* the nasal end of this bone is either flat or slightly concave.

Maxillo-premaxillary Region, Rostrum, or Beak.—In *Balæna* the beak is distinguished by its high antero-posterior arch and narrow palate, from the relatively flattened dorsum and wide palate in *Balænoptera* and *Megaptera*. In *Balæna* the tip of the beak is pointed and formed by the premaxillæ; the length of the beak is five times greater than the breadth at the base: in *B. musculus* the side of the beak is not quite straight, and the length is nearly twice the breadth at the base: in *B. sibbaldi* the side of the beak is more convex, the superior and the premaxillæ turn inwards at the tip, and the length is about $1\frac{1}{2}$ more than the breadth. In *B. borealis* the side of the beak is straight, the superior and premaxillæ extend directly forwards to the tip; but at its base the superior maxilla curves gently outwards; the length of the beak is rather more than twice the breadth. In *B. rostrata* the tip is pointed, the sides are straight, the interval between the premaxillæ widens out to an ellipse in front of and opposite the base, and the length is about $1\frac{5}{6}$ more than the breadth.

In the above measurements, as well as in those which are to follow, I have not, as is the practice with some anatomists, compared the length of the beak with that of the entire skull. I have preferred to take the length of the beak from the tip to the notch in the superior maxilla which marks the line of the base, whilst the base is measured in a straight line between the opposite maxillary notches. By these measurements a better idea can be formed of the range in outline of the beak, from a broad triangle such as exists in *Orca* and *Globicephalus*, to the long, narrow, rod-like beak in *Platanista*.

In *Ziphius* the character which at once arrests attention is the dense medio-rostral bone which occupies and is fused with the spout-like vomer in the interval between the two premaxillæ, and the length of the beak is about $1\frac{1}{2}$ times more than the breadth. In *Hyperoodon* the medio-rostral cartilage is little if at all ossified, and the length is about $2\frac{1}{2}$ times more than the basal breadth. In *Mesoplodon* the medio-rostral is ossified in the adult; the beak is more slender than in *Ziphius*, and its length is about $2\frac{1}{2}$ times more than the breadth at the base. In *Platanista* the beak is compressed laterally so that the length varies in different specimens from 8 to 12 times more than its breadth at the base.

In the *Delphinidæ* the surface of the premaxillæ in the beak itself is not uniform. In a number of species, as *Beluga*, *Globicephalus*, *Grampus*, *L. albirostris*, *D. delphis*, *Prodelphinus*, and *Tursiops*, it is convex, a character which extends as far as or near to the tip; in *Phocæna* and *Orcella* the convexity is faintly marked; in *Monodon*, *Cephalorhynchus*, *Orca*, and *L. acutus* the premaxilla is smooth, flattened, or at times faintly concave; and in *Globicephalus* the premaxilla is so broad as largely to conceal the superior maxilla. The proportion of the length of the beak to the breadth at the base varies with the species. In *D. delphis* the length is 3 times more than the breadth; in *Tursio*, *L. acutus*, *Cephalorhynchus*, and *Beluga* the length is about twice greater; in *Phocæna* and *Orca*, about $1\frac{2}{3}$;

in Monodon, Orcella, Grampus, *L. albirostris*, about $1\frac{1}{2}$; and in Globicephalus the length is about $1\frac{1}{3}$ more than the breadth at the base.

The Pterygoids and Hard Palate.—In the Baleen Whales the pterygoids are small and separated mesially by a wide cleft; the palate plates of the palate bones are large. In Physeter, Hyperoodon, Ziphius, and Mesoplodon the pterygoids are large and meet mesially.

In an important memoir Sir Wm. Flower pointed out (*Proc. Zool. Soc.*, 1883) the characters of the pterygo-palatal region in the classification of the Delphinidæ, and subsequently Mr F. W. True, in his Review of the Delphinidæ, has gone over the same ground. It may be sufficient, therefore, if I confine myself to a brief statement of the characters observed in the skulls in the Anatomical Museum.

The hinder end of the hard palate is formed by the pair of pterygoids situated immediately behind the palate plates of the palate bones; each is hollowed into a sinus opening backwards. They lie in the same transverse plane, but their relations to the middle line vary with the species. Thus, in Beluga, Cephalorhynchus, Phocæna, Orcella, and in some skulls of Orca they are separated by a wide cleft; in Globicephalus, and sometimes in Orca, the interval is a narrow fissure; in Monodon, Grampus, *L. albirostris* and *acutus*, Delphinus, Tursiops, they meet mesially and complete the hard palate behind. The palatal plate of the palate bones in Globicephalus, Phocæna, Delphinus sends a process backwards which intervenes between the more anterior half of the inner borders of the two pterygoids.

The hard palate is chiefly formed by the pair of superior maxillæ which usually articulate in the middle line. Sometimes, as in Physeter, Hyperoodon, Ziphius, Mesoplodon, Tursiops, Lagenorhynchus, Prodelphinus, they do not meet mesially in their whole length, and allow the lower edge of the vomer to appear. The premaxillæ are only visible in the palate near the tip. In the Baleen Whales the palate is perforated by large foramina for the blood-vessels and nerves which supply the folds and papillæ on the mucous membrane, from which the baleen plates are developed and grow. In Balæna the palate has a strong keel in the middle line, which is not so marked in Balænoptera.

Delphinus, as the genus is now limited, is distinguished from other Delphinidæ by a mesial palatal ridge and a wide, deep longitudinal groove on each side of the ridge.

Teeth.—It is now recognised that in the Cetacea generally rudiments of teeth are formed in the gums of the fœtus. In the Mystacoceti they disappear at an early stage, never cut the gum nor possess functional value. In the Odontoceti, again, the teeth develop and acquire functional importance. As a rule, the teeth are small, conical in shape, and have the same form in whatever part of the jaw they are situated, though sometimes they assume specific characters. In Layard's Mesoplodon, for example, a pair of mandibular teeth grow to form broad, strap-like fangs of great size which enclose the beak of the upper jaw. In Sowerby's Whale a

pair of mandibular teeth are triangular in shape and laterally compressed. In the Narwhal the single developed maxillary tooth forms a spirally twisted horn, or tusk, 8 to 10 feet long. In the Porpoise the numerous small teeth are spade-like in form, some of which show indications of cusp-like projections.

In the descriptive part of the Catalogue the skulls of several species are described, *e.g.* *Platanista*, *Phocæna*, *Cephalorhynchus*, *Lagenorhynchus*, *Delphinus*, *Tursiops*, *Steno*, where the teeth are numerous in both upper and lower jaws; in others, as *Orca*, *Globicephalus*, the teeth are greatly diminished in number, and are situated at the anterior ends of both jaws; in *Physeter* numerous functional teeth are found in the mandible; in *Grampus* only three or four teeth are present on each side of the symphysis of the mandible; in *Ziphius* and *Hyperoodon* the fully developed teeth are reduced to a pair at the free end of the mandible, but as they are almost buried in their sockets they can have but little functional value.

The Tympano-Periotic Bones.—In *Balæna* the height of the *Tympanic*, though not equal to the length, is materially greater than the breadth; the keel on the lower aspect is very prominent; the outer surface is divided by a long, wide, oblique groove into two unequal convexities, of which the posterior is much the larger; the inner surface is convex and striated, and its upper border, where it turns into the tympanic cavity, is nearly horizontal, and at its anterior or Eustachian end is notched, and well above the keel. In *B. mysticetus* this border is thicker than in *B. australis* and *biscayensis*, though not so thick and rounded as in *Balænoptera* and *Megaptera*.

In *Balænoptera* the height is almost the same as the breadth, and each of these is much less than the length. The inferior keel is not so prominent as in *Balæna*, and the adjoining surfaces are not so laterally compressed. The groove which separates the outer surface into two unequal convex divisions is short and comparatively narrow. The inner surface is convex, and where it turns round into the cavity is striated, much thicker, and more rounded at the upper nearly horizontal border than in *Balæna*; anteriorly it is notched for the Eustachian tube. *B. sibbaldi* and *B. musculus* can be distinguished from *B. borealis* and *B. rostrata* by their larger dimensions. In *B. musculus* the inner surface is more convex, the keel is not so sharp, and the adjoining surfaces are not so laterally compressed as in *B. sibbaldi*. *B. borealis* has the outer surface less convex, the anterior border is not so well defined by a groove, the keel is a narrow ridge, the inner surface is more flattened than in *B. musculus*. In *B. rostrata* the height is more than the breadth; the two divisions of the outer surface are almost equal in antero-posterior diameter.

In *Megaptera* the height and breadth are almost equal, the two divisions of the outer surface are prominently convex, the inner surface is also distinctly convex; the anterior end is blunt and

continued into the keel; the posterior end shows a differentiated ridge. Entrance to the cavity has a thick, rounded, striated border, with somewhat depressed notch at Eustachian end. The keel is not prominent, and blends with the roughened adjoining inner and outer surfaces.

The Tympanic in the Odontoceti is readily distinguishable from this bone in the Baleen Whales; on the inner surface the lower border of the entrance to the tympanic cavity is not horizontal or nearly so, but slopes downwards and forwards, so that the Eustachian end is immediately above the anterior end of the inferior surface. In *Physeter*, a toothed whale of gigantic proportions, the bone is smaller even than in *B. rostrata*, which has scarcely half the bulk of the Sperm Whale. Even in an adult male Cachalot its length was only $2\frac{1}{2}$ inches. Its outer surface in the posterior part is raised into a strong, curved ridge, continuous with the malleolar or lip-like process on the upper border, and prolonged downwards to the inferior surface. The inferior surface is grooved and bilobed behind; the outer is larger than the inner lobe, roughened in front, above the anterior end of which the Eustachian mouth of the cavity opens by an arch-shaped orifice. In *Kogia* the tympanic is not raised on the outer surface into a prominent ridge as in *Physeter*. The bone is bilobed posteriorly, the outer being the larger; the inferior surface is smooth; the inner surface is bounded above by the rounded border of the opening into the cavity, which is divided by a shallow depression into an anterior and a posterior part; the Eustachian end of the cavity opens by an arched border.

In the Ziphiinæ the tympanic varies in its characters. In *Hyperoodon* it is almost as large as in the sperm whale; the upper border of the outer surface gives rise to a curved lip-like process, but its extension down the surface is feeble. A well-marked outer lobe is behind, but the inner is a rudimentary tubercle; a narrow rough ridge, forming a low keel, projects from the inferior surface, close to the Eustachian opening at its anterior end. In *Ziphius* the lip-like process is limited to the upper border of the outer surface; the inferior surface has a low keel which ends behind in the projection or outer lobe, though the inner lobe is represented by only a minute tubercle; the Eustachian opening is close to the anterior end of the inferior surface. In *Mesoplodon*, again, the tympanic is definitely two-lobed behind—the outer, the larger, smooth and rounded; the inner well marked, separated from the outer by a shallow cleft; the inferior surface, relatively broad, is not keeled but grooved, and the Eustachian opening is close to its anterior end.

In *Platanista* the tympanic is 2 inches long, bilobed posteriorly, the outer being the larger lobe; inferior surface is grooved and is prolonged into a pointed process, immediately above which is the Eustachian opening of the tympanic cavity. The lip-like process projects feebly from about the middle of the upper border.

In the Delphinidæ the tympanic is bilobed posteriorly, and the outer is larger than the inner lobe. The lobes are best seen on the

inferior surface, where they are separated by a cleft, varying in width and depth in different species, which is usually limited to the region of the lobes, though sometimes, as in *Tursiops* and *Monodon*, it is prolonged forward on the inferior surface as a median groove. The outer lobe is smooth and rounded, the inner is usually roughened and pointed, though in *L. acutus*, *Tursiops*, and *Cephalorhynchus* it is more truncated. The outer surface has about its middle a low raised process, which is continued into the lip-like malleolar process on the sharp upper border of this surface, but is not prolonged to the inferior surface.

The *Periotic* proper is a dense, hard bone, which is fused with the tympanic in the adult. Its cerebral surface is pierced by one or two large canals for the auditory nerve; its tympanic surface, next the cavity, has two fenestræ, the ovalis and rotunda, to the former of which the stapes sometimes remains attached, though the incus may have been lost and the malleus fused with the lip-like process of the upper border of the outer surface of the tympanic. In the Baleen Whales the periotic proper, which encloses the internal ear, is much smaller than the tympanic, and is smooth and convex on its inferior surface; but continuous with it a mass of cancellated bone, by which it is attached to the squamosal, is sometimes regarded as a mastoid process.

In the Toothed Whales the periotic is not so strongly anchored to the squamosal as in the Baleen Whales, and is more easily lost. In many species it is not so long and broad as the tympanic, but *Hyperoodon* and *Orca* form exceptions. A plate-like surface at the posterior end of the periotic articulates with a corresponding surface of the tympanic. In *Hyperoodon*, *Mesoplodon*, *Ziphius*, and *Phocæna*, they are plane surfaces, and the articulation is one of apposition. In *Physeter* and many Dolphins, as *Globicephalus*, *Orca*, *Grampus*, they are concave and striated, and the articulation is feebly denticulated. A rounded, bullet-shaped prominence, immediately below and on the tympanic side of the internal auditory meatus, marks the position of the labyrinth.

For purposes of Classification the Cetacea are arranged in two sub-orders, *Mystacoceti* and *Odontoceti*.

The *Mystacoceti* (M.C.) (Whalebone Whales) consist of the families *Balænidæ* (Right Whales) and *Balænoptæridæ* (Rorquals).

The *Odontoceti* (O.C.) (Toothed Whales) consist of the families *Physeteridæ* (Sperm and Beaked Whales), *Platanistidæ* (Fresh-water Cetacea), and *Delphinidæ* (Dolphins).

SPECIMENS OF CETACEA.

Suborder 1. MYSTACOCETI. (M.C.)

(Whalebone, Baleen, or True Whales.)

Family I. BALÆNIDÆ.

(Right Whales.)

Head large relatively to body; skull almost symmetrical, strongly arched; mouth capacious, baleen narrow; skin of throat and chest not plicated; cervical vertebræ fused, distinct lachrymal bone, mandible without proper coronoid process; ribs articulate with transverse processes and not with bodies of vertebræ.

I. BALÆNA. (B.)

Balæna, *Linneus*, *Syst. Nat.*, 1766.

No dorsal fin; length 50 to 60 feet; pentadactylous. Scapula high, with distinct coracoid and acromion.

(1) BALÆNA MYSTICETUS. (B. M.)

(Greenland or Arctic Right Whale, Bowhead.)

Balæna mysticetus, *Linneus*.

Colour black, white throat; thirteen pairs of ribs; baleen narrow, 11 feet or more in length.

1. **Skeleton**, articulated, young; length, 24 feet 5 inches. Length of skull in straight line, 7 feet 10 inches. Vertebral formula $C_7D_{13}LCd_{36}=56$. See Plate I.

Greenland Seas.

Goodsir Collection.

2. **Skull** of an older specimen without mandible; length over curve of head, 13 feet 4 inches; length in straight

line, 11 feet $3\frac{1}{2}$ inches; breadth 5 feet 7 inches; length of maxillary beak from notch, over curve 9 feet $8\frac{1}{2}$ inches, in straight line 8 feet 8 inches; breadth at base across maxillary notches 1 foot $9\frac{1}{2}$ inches. Nasals flattened on dorsum, 1 foot long, $2\frac{1}{2}$ inches in greatest breadth.

Greenland Seas.

Goodsir Collection.

[Nos. 1 and 2 were obtained by Professor John Goodsir through captains of whaling ships.]

3. **Fœtus**, young, of *B. mysticetus*, stuffed and dried. It was removed *ab utero* in the Arctic seas, and when fresh was 2 feet $4\frac{1}{2}$ inches long from the snout to the end of the tail. It was dissected by Dr Robert Knox and was in the Museum formed by him and Mr F. J. Knox. Descriptions were published in the *Catalogue*



of their Museum, Edinburgh, 1838, and in *Proc. Linn. Soc.: Zool.*, 1857. An interesting feature is the presence of a horizontal flap or fold of skin on each side, $4\frac{1}{4}$ inches long and 1 inch wide, continuous with the edge of the lower lip, and extending from the angle of the mouth to 1 inch from the anterior end

of its opening. Knox considered that in the growth of the whalebone this flap covered and prevented its extrusion through the side of the mouth. Figure, p. 22. Knox Collection, No. 54.

4. **Skeleton** of the same *fœtus*, which, though dried and somewhat shrivelled, forms a natural skeleton. The length of the cranium is 8 inches, that of the spinal column 18 inches, together 26 inches. The summit of the cranium is imperfect, but ossification of the base, side walls, and jaws has materially advanced. The curvature of the spine has been preserved by introducing a wooden rod, modelled, into the spinal canal. The bodies and neural arches of the vertebræ show centres of ossification in the dried cartilage. Knox gives the vertebral formula $C_7D_{13}LCd_{23}=48$. A partial ossification of the pectoral limbs has taken place. The pair of pelvic bones are also partially ossified. Knox Collection, No. 55.

[Nos. 5 to 7, from the above *fœtus*, preserved in spirit, were in the Knox Museum, in the Catalogue of which, pp. 22 and 23, it is stated that from sixty to seventy dentar pulps were dissected in each jaw on each side. Knox, in succession to G. St Hilaire and Cuvier, described the rudimentary teeth in *B. mysticetus* and recognised that the dentar pulps disappeared. He regarded the baleen as a modified form of hair and cuticle belonging to the integumentary system.]

5. **Teeth**, rudimentary. Sixteen dentar pulps with gum from the alveolar border of the upper jaw.
6. **Teeth**, rudimentary. Seven dentar pulps dissected out of the gum of the same *fœtus* and fixed upon a tablet. A white calcareous incrustation may be seen on the pulps.



[The upper figure shows eleven dentar pulps and the gum, the lower four pulps dissected out of the gum.]

7. **Teeth**, rudimentary. Twelve dentar pulps together with gum from the border of the jaw.

8. **Tympanic** bone, right; length $5\frac{1}{2}$ inches, 3 inches in greatest breadth and $4\frac{1}{4}$ inches in vertical height. The outer surface presents two convex divisions, separated by a long, wide, deep groove; the posterior, much the larger, has on it a shallow groove which limits the lip-like process behind; lower down the outer surface is concave. The inner surface is convex, and striated with vertical grooves. The lower aspect presents a strong keel-like ridge which extends along its whole length. At the upper, moderately thick, horizontal border of the inner surface the tympanic cavity opens, the anterior or Eustachian end being slightly notched. Knox Collection.
9. **Tympanic** bone, right. Nos. 9, 10, 11 similar to No. 8 in their characters. Knox Collection.
10. **Tympanic** bone, right.
September 1888. Donor—Mr John M'Donald,
s.s. "Maud," Dundee.
Turner Collection.
11. **Tympanic** bone, right.
12. **Tympano-periotic** bones, adult, left, fused together.
Tympanic 6 inches long, $3\frac{5}{8}$ inches in greatest



breadth; height $4\frac{1}{4}$ inches; surfaces and keel-like ridge strongly marked; lip-like process bounded

behind by a deep notch in upper border; cavity opens along inner surface by a moderately thick horizontal border $3\frac{1}{8}$ inches above keel: Eustachian end slightly notched. Periotic relatively small, massive mastoid. Auditory nerve canal distinct; tympanic ossicles present. Figure, p. 24, outer surface of tympanic.

13. **Tympano-periotic** bones, fused, left, similar in character to No. 12.
14. **Tympanic** bone, left. Dr Debuc's Collection.
15. **Tympanic** bone, right, half of: the great thickness of the wall of the bulla is shown in the section.
16. **Tympanic** bone, right, probably from a young *B. mysticetus*.
17. **Tympanic** bone, left, probably *B. mysticetus*.
Dr R. Broom's Collection.
18. **Tympanic** bone, right, probably *B. mysticetus*.
19. **Baleen** plate, 47 inches long, 5 inches in greatest width at base, bristles slender. Colour slate grey, striped.
1888. Donor—Mr John M'Donald, s.s. "Maud."
Turner Collection.
20. **Baleen**. Nine small plates from the foetus of *B. mysticetus*, $3\frac{1}{2}$ inches long and $\frac{3}{4}$ inch wide. Colour greyish white. Wet preparation. Donor—Prof. P. J. van Beneden.
21. **Cast** of cranial cavity; greatest width 18 inches. Cerebrum, cerebellum, rhinencephalon, medulla indicated. From a skull in the Museum of the Royal College of Surgeons, England. Purchased.
22. **Vertebral** plates, four, of caudal vertebræ.
[Nos. 23 to 30 are from the Collection made by Professor Sir John Struthers, and were presented by him. He has described the sternum in *Journ. of Anat. and Phys.*, vol. xxix. p. 593, 1895; the carpus in the same volume, p. 145; the rudimentary hind limbs in vol. xv., 1881. The tibia in vol. xv. p. 160, whale marked No. 11.]
23. **Sternum** of Right Whale, an expanded oval plate, length 27 inches, breadth 20 inches, articulating with the first pair of ribs.
From Cumberland Sound, Davis Straits.
24. **Fore limb**, articulated skeleton of right, young male; carpal region modelled in wood. Length of humerus $15\frac{1}{2}$ inches, of radius 18 inches, of ulna 20 inches.

25. **Carpus**, dried section of palmar half of right, showing three ossicles in the cartilage, the cartilaginous epiphyses of radius and ulna, also of the carpal ends of metacarpals. From a male Greenland Right Whale 35 feet long.
26. **Carpus**. Dried section of dorsal half of the same carpus, with the three ossicles.
27. **Carpus**, dried section of left, from female Right Whale 48 feet long. Two large ossified carpals, also two unossified. Radial and ulnar carpal epiphyses. Dried cartilaginous ends of metacarpals.
28. **Right pelvic** bone and rudimentary femur ankylosed to each other; the corresponding left bones and the cartilaginous tibiæ are modelled in wood.
29. **Left pelvic** bone and femur; the corresponding right bones and both cartilaginous tibiæ are modelled in wood.
30. **Tibia**, longitudinal section through the cartilaginous, of a Mysticete. The cartilage is invested by a thick perichondrium, and shows vacuities which probably contained blood-vessels. The surface of articulation for the femur is at the upper end.
31. **Tongue**, the anterior end, from the foetal *B. mysticetus* (No. 3), showing the fixing of the tip to the floor of the mouth by a relatively thick frænum. Mucous membrane of dorsum smooth, whilst the sides are furrowed. The tongue weighed 9 oz., the foetus itself 7 $\frac{1}{4}$ lb.
Knox Collection, No. 70.
32. **Tongue**. Transverse section through the middle of the tongue of the same foetus. The mucous surface of dorsum is smooth; that of the sides is raised in folds.
Knox Collection?
33. **Stomach** of foetal *B. mysticetus*, showing three distinct compartments, cesophageal, intermediate, and pyloric. The last communicates with the duodenum, into which the biliary and pancreatic ducts open.
Knox Collection, No. 61.
34. **Heart** of foetal *B. mysticetus*, with pulmonary artery, its two branches, and the aorta. The ventricles have been opened into, and the auriculo-ventricular valves are displayed. The ductus arteriosus, the brachio-cephalic and left carotid arteries are exposed. The heart is short, broad, flattened, and without a distinct apex.
Knox Collection, No. 64.

35. **Rete mirabile** lining the inner surface of the dura mater of a Whale; the vessels are injected with wax. The specimen may possibly have been from a *B. mysticetus* in the Knox Museum.
36. **Skin.** Section of skin of adult *B. mysticetus*. The cuticle, 1 inch thick, has been partially reflected from the cutis, and the long papillæ of the latter have been drawn out of the deep part of the cuticle, the striated appearance of which shows where the papillæ had been lodged and the extent of their penetration into the cuticle.
Knox Collection, No. 73.
37. **Skin.** Thick cuticle of the Greenland Whale. The attached surface, mottled with black pigment, shows the minute holes and grooves for the passage of the papillæ of the cutis; the sides of the section through the cuticle show the striated appearance produced by the spaces in which the papillæ are lodged.
Knox Collection, No. 74.
38. **Hair.** Lip of a *fœtal* Mysticete; two delicate hairs project from it and form a rudimentary moustache; a groove for other hairs is present. See figure below.



39. **Brain** of *B. mysticetus*, without membranes, removed from the skull by Dr Robert Gray. Weight 4 lb. 8 oz.
Donor—Sir John Batty Tuke, M.P.
40. **Eyeball**, antero-posterior section of adult *B. mysticetus* 45 feet long, showing the external coats and the vascular rete surrounding the optic nerve. The diameter of the eyeball is 3 inches transversely, $1\frac{7}{8}$ inch antero-posteriorly. Knox Collection, No. 78.
41. **Eyeball**, transverse section of Mysticete, showing on one aspect the optic nerve, with the vascular rete mirabile which surrounds it before it pierces the sclerotic: on the other aspect the nerve is seen after

it has pierced the sclerotic, also the openings for the ciliary arteries. Knox Collection, No. 79.

[The preparations of the eyeball No. 42 to No. 53 were part of the Goodsir Collection.]

42. **Eyeball**, anterior segment, showing section through sclerotic, choroid, retina, iris, and ciliary processes, also a linear pupil. On the front of the globe are the cornea and the conjunctiva.
43. **Eyeball**, anterior segment from a Mysticete. The cornea covered by the conjunctiva in front; a coronal section has been made through the coats to show the vitreous body occupying the space in front of the retina.
44. **Eyeball**, posterior segment of the choroid of Mysticete, showing the vasa vorticosa; the retina is partially separated from the anterior surface of the choroid.
45. **Eyeball**, posterior segment of the globe of Mysticete, showing sclerotic, choroid, retina partially detached, and the remains of the vitreous body.
46. **Eyeball** of the Mysticete in transverse section, showing the fibrous sclerotic, and the tubes for the transmission of the optic nerve and the long and short ciliary arteries.
47. **Eyeball**. Antero-posterior section through the coats, showing the retina detached from the choroid and connected with the optic nerve. The cornea and iris form the anterior part of the section.
48. **Eyeball**. Antero-posterior section through the globe of a Mysticete, showing the coats, the lens, the vitreous body, and the optic nerve.
49. **Eyeball**, the greater part of the, of *B. mysticetus*. Cornea removed, showing front of iris and pupil; sclerotic cleaned of its muscles.
50. **Eyeball**. Coronal section with the cornea removed, showing the iris, the ciliary processes, and the anterior part of the retina.
51. **Eyeball**. Antero-posterior section, showing optic nerve, the large rete mirabile which encloses it, the choroid with its pigment, tapetum, and iris
52. **Eyeball**. Antero-posterior section of optic nerve, rete mirabile, and sclerotic; the iris, lens, and choroid have been retained, and the outer surface of the choroid shows the vasa vorticosa.

53. **Eye-ball.** Annular section through the equator of the sclerotic of *B. mysticetus*, showing the apertures of the vasa vorticosa.
54. **Ear.** Three blocks of the integument surrounding the meatus auditorius externus of a *B. mysticetus*, showing the differences in size of the meatus at its deep end and as it approaches the surface. The whale was a male 40 feet 6 inches long, and the meatus opened 16 inches behind the posterior canthus of the eye. See Dr Robert Gray, *Journ. Anat. and Phys.*, vol. xxiii., 1889.

(2) BALÆNA AUSTRALIS. (B. AU.)

(Southern Right Whale.)

Balæna australis, *Desmoulins, Dict. Class d'Hist. Nat.*,
ii. p. 161, 1822.

Body smaller than *B. mysticetus*, head relatively smaller, baleen shorter, ribs fifteen pairs.

1. **Vertebrae**, cervical and 1st dorsal, fused into one mass. The inferior transverse processes are present in the 2nd, 3rd, and 4th cervicals, but not in the 5th, 6th, and 7th. The block was marked "Right Whale of New Zealand," captured at Kaipara. See Turner, *Challenger Reports*, vol. i., 1880.

"Challenger" Collection.

2. **Tympano-periotic** bones, right, fused, with long mastoid process; length 5 inches, breadth 3 inches, height $4\frac{1}{8}$ inches; wide cleft behind lip-like process. Outer and inner surfaces closely correspond with *B. biscayensis*; upper border of inner surface relatively thin, 3 inches above keel; Eustachian end deeply notched. Keel strongly projecting, adjoining surfaces laterally compressed. Periotic, length $2\frac{7}{8}$ inches, breadth $1\frac{5}{8}$ inch. Auditory canals wide and long. Tympanic ossicles absent.

From Te-Awite, New Zealand, September 1888.

Purchased—Turner Collection.

3. **Tympano-periotic** bones, left, fused, with long mastoid; length, breadth, height, and other characters as above.

From Te-Awite, New Zealand, September 1888.

Purchased—Turner Collection.

(3) *BALÆNA BISCAYENSIS*. (B. BL.)

(North Atlantic Right Whale.)

Baleine des Basques, *Fischer*, *Ann. des Sc. Nat.*, 1871.*Balæna biscayensis*, *Eschricht*, *Van Beneden and Gervais*.*Nord Caper of Lacépède and Eschricht*.

Much smaller than *B. mysticetus*. Baleen narrow, about half as long as in *mysticetus*. So similar is it in characters to *B. australis* that many systematic writers regard *B. biscayensis* as only the North Atlantic form of *B. australis*.

1. **Tympano-periotic** bones, fused, left; apparently adult. Tympanic, length $5\frac{1}{8}$ inches, breadth $3\frac{3}{8}$ inches, height $4\frac{3}{8}$ inches. Outer surface separated into two unequal convex divisions by long, deep, wide groove; posterior $3\frac{1}{4}$ inches, anterior $1\frac{5}{8}$ inch. Lip-like process from upper border limited behind by deep notch. Inner surface moderately convex and striated, upper border relatively thin $3\frac{1}{8}$ inches above keel, terminating at Eustachian end in deep notch (figure below). Lower aspect strongly keeled, the adjoining surfaces laterally compressed. Periotic, $2\frac{5}{8}$ inches long, $1\frac{3}{4}$ inch broad: inferior surface smooth and convex. Auditory canal



divided into two: tympanic ossicles absent. A large mastoid for articulation with temporal. Whale about 40 feet long. Captured, 1910, west of St Kilda.

Donor—W. Eagle Clark, Esq.

2. **Skull and Earbones.** *See* Addenda.

II. NEOBALÆNA. (N.B.)

Neobalæna, Gray, *Suppl. Cat. Whales and Seals*, 1871.

About 20 feet long, small falcate dorsal fin; tetradactylous. Scapula with coracoid and acromion.

(1) NEOBALÆNA MARGINATA. (N.B. M.)

Neobalæna marginata, Gray, *ut supra*.

Balæna marginata, Gray, *op. cit.*; Hector, *Trans. N. Zealand Inst.*, 1869.

Seventeen pairs of broad, flattened ribs. Vertebral formula $C_7D_{17}L_3Cd_{16} = 43$.

1. **Baleen**, two plates, $27\frac{1}{2}$ inches long; greatest width at base, $2\frac{7}{8}$ inches; bristles very fine; colour, black band on outer straight border, elsewhere white. Sir J. Hector in *Proc. N. Zealand Inst.*, 1869.

Island of Kawau; from Colonial Museum, New Zealand.

Donor—Sir James Hector, K.C.M.G.

III. RACHIANECTES. (R.H.)

Rachianectes, Cope, *Proc. Acad. Nat. Sc. Philadelphia*, 1869.

No proper dorsal fin, only two folds on skin of throat; pectoral fin narrow.

(1) RACHIANECTES GLAUCUS. (R.H. G.)

(Pacific Grey Whale.)

Agaphelus glaucus, Cope, *Proc. Acad. Nat. Sc. Philadelphia*, 1868.

Colour mottled grey to black: head small; length 40 to 45 feet; baleen light-coloured, approaching white, less than 2 feet long; ribs fourteen pairs; sternum cruciform. The only species.

No specimen in Museum.

Family II. BALÆNOPTERIDÆ.

(Rorquals.)

Compared with Balæna, head not so large relatively to body, skull feebly arched, baleen shorter and wider; skin of throat and chest plicated; dorsal fin; wide foramen at root of cervical transverse processes; mandible with a coronoid process.

I. BALÆNOPTERA. (Bpt.)

Balænoptera, *Lacépède, Hist. Nat. des Cétacées*, p. xxxvi, 1804.

Fin Whales, Finbacks, Rorquals; dorsal fin distinct, cervical vertebræ not fused; tetradactylous; ribs articulated with transverse processes and not with bodies of vertebræ. Scapula low, broad; coracoid and acromion large.

(1) BALÆNOPTERA MUSCULUS. (BPT. M.)

(Common Rorqual, Fin Whale, or Razorback.)

Balæna musculus, *Linn., Syst. Nat.*, 1766.

Balæna tripinnis quæ rostrum acutum habet et plicas in ventre, *R. Sibbald, Phalainologia nova, Edinburgh*, 1692.

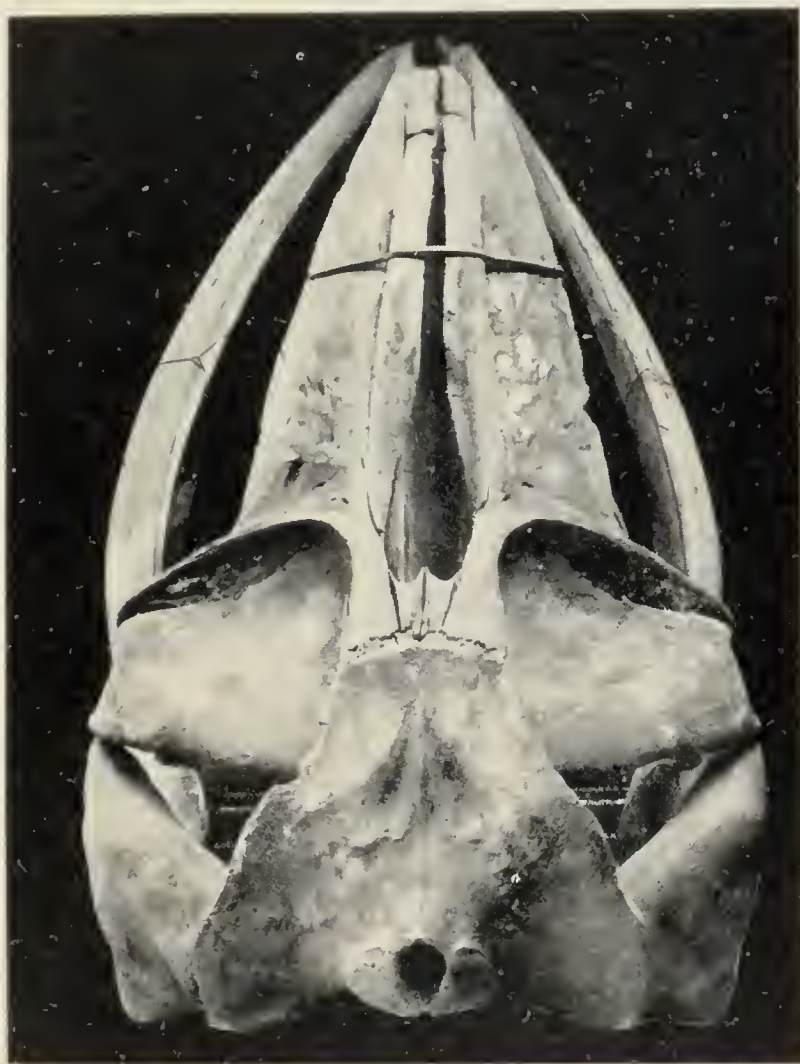
Balænoptera musculus, *Van Beneden and Gervais, Ostéographie des Cétacées; Flower, Turner, and others.*

Balænoptera physalus, *True, Smithsonian Contributions*, vol. xxxiii., 1904.

Colour greyish slate on back and sides, belly white; not exceeding 70 feet; fifteen pairs of ribs; dorsal fin relatively low; pectoral limb about 7 feet, margins almost straight. Baleen mottled; outer border of upper jaw almost straight. $C_7D_{15}L_{15}Cd_{26} = 63$.

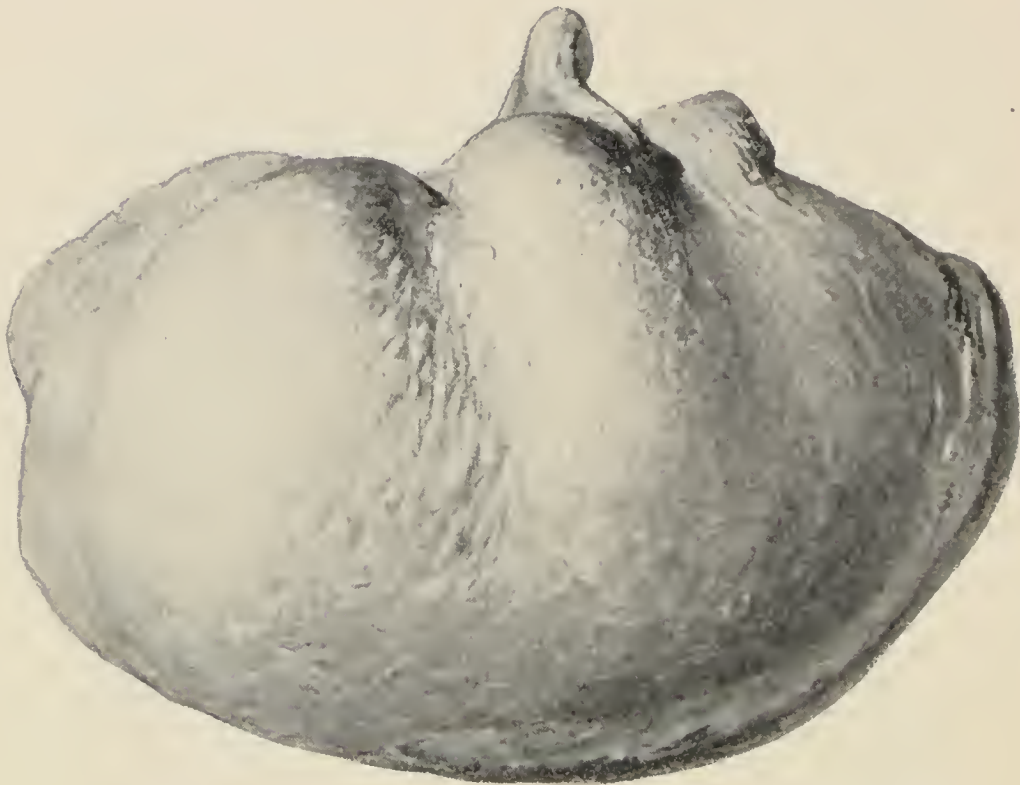
1. **Skull**, with mandible; right baleen wreath *in situ*. Length 9 feet 2 inches; greatest breadth 4 feet 10 inches; length of maxillary beak 5 feet $9\frac{1}{2}$ inches, breadth at base 3 feet 2 inches. Nasals $7\frac{5}{8}$ inches long in middle line, $8\frac{1}{4}$ inches at the outer border, greatest breadth $2\frac{5}{8}$ inches; length of mandible on outer convex surface 9 feet 6 inches, in straight line 8 feet $11\frac{1}{2}$ inches; girth in front of coronoid

1 foot 10 inches. The maxillary borders of the jaw show a faint convex outline. See figure below.
 Whale, nearly 50 feet long, stranded at the Old Bar, Aberdeen, 1889. Turner Collection.



2. **Tympanic** bones, pair of broken, from the Aberdeen skull of *B. musculus*, No. 1. Turner Collection.
3. **Tympanic** bone, left, from *B. musculus*, 60 feet long, adult, stranded at Sandvøe, Northmaven, Shetland. Length $5\frac{1}{4}$ inches, breadth 3 inches; vertical height $3\frac{1}{4}$ inches. Outer surface, more convex than in *sibbaldi*, consists of a posterior larger and an anterior smaller division separated by a short vertical groove; the distance from the groove to the posterior border is $3\frac{1}{4}$ inches, and to the anterior border $2\frac{1}{2}$ inches. The lip-like process ascends from the posterior division and is bounded behind by a narrow groove. The anterior border is differentiated into a ridge by a deep groove immediately behind it. The inner surface is more convex than in *sibbaldi*; the keel-like inferior

border is not so sharp as in *sibbaldi*, and the bone on each side is not so much compressed laterally as in Sibbald's Whale. The tympanic cavity opens hori-



zontally at the thick, rounded upper border of the inner surface $2\frac{1}{8}$ inches from the keel; Eustachian end slightly notched. Figure of outer surface above.

November 1887.

Donor—Dr Chas. Anderson.
Turner Collection.

4. **Tympano-periotic** bones, the left fused; with tympanic ossicles; probably *B. musculus*. Length $4\frac{1}{2}$ inches, breadth $2\frac{3}{4}$ inches. Monro Collection.

- 4A. **Tympanic** bone, left; length 5 inches, breadth $2\frac{7}{10}$ inches, vertical height 3 inches; outer surface very convex, a short wide groove separates it into a longer posterior and shorter anterior division; inner surface convex, striated and rounded at the upper curved border where it turns into the cavity; inferior surface keeled, not very prominently, but continued behind into a border much stronger than the anterior border.

Donor—Dr A. Logan Turner, 1912.

5. **Vertebra**, portion of; the plates are ossified to the body: possibly *B. musculus*.

The Camps, Wick.

Found in 1893, during drainage operations, and believed to belong to a whale stranded there in 1782.

Donor—Bailie Chas. Bruce, Wick.

[Nos. 6 to 9 were presented by Sir John Struthers, and were described by him in *Journ. of Anat. and Phys.*, vol. vii., 1872; vol. xxix., 1895, pp. 147, 593.]

6. **Vertebræ**, seven cervical and 1st dorsal; bones not fused together.

Animal stranded near Wick, June 1869.

7. **Vertebræ**, axis and four succeeding cervicals, neural arches ossified, transverse processes incomplete; probably a young *B. musculus*.

8. **Sternum**, flattened cruciform bone; transverse diameter 2 feet, antero-posterior 1 foot $5\frac{1}{2}$ inches.

From a Fin Whale caught in Davis Strait.

9. **Fore limb**, articulated skeleton of right, adult male; length of humerus $21\frac{1}{4}$ inches, of radius 3 feet, of ulna 3 feet 2 inches.

[Nos. 10 to 15 are from the collection formed by Professor Sir Wm. Turner.]

10. **Baleen** plate from Rorqual, 60 feet long, stranded at Sandvøe, Northmaven, Shetland, November 1887. In colour, form, and dimensions characteristic of *B. musculus*. See No. 3.

Donor—Dr Chas. Anderson.

11. **Baleen** plate from Finner, 64 feet long, stranded at Whale Rock, Kingask, St Andrews Bay, in January 1848. Colour mottled, yellow, slate-coloured, brown and black, striped; bristles stiff, white grey. Length 26 inches; greatest width $7\frac{3}{4}$ inches.

Donor—R. Jameson, Esq., of Kingask.

12. **Baleen** plates from a specimen captured at Harris, in the Hebrides, November 1905. Average length 27 inches, greatest width 11 inches. Most of the plates have the customary mottled, striped appearance of *B. musculus*; but one is yellowish white, striped with grey; in all the bristles are white.

Donor—Dr Duncan Fletcher.

13. **Baleen** plate of Rorqual, stranded at Quendale, Shetland, November 1879. Length $25\frac{1}{2}$ inches, width $13\frac{1}{2}$ inches; colour mottled as in this species, though somewhat darker than usual.

Donor—G. H. Wildert, Esq.

14. **Baleen** plates, two in number, from specimen from Stornoway, November 1871. Colour, form, and dimensions characteristic of *B. musculus*.

15. **Baleen.** One of the small plates of a Finner, 66 feet long, probably *B. musculus*, stranded in the Severn, January 1885. The plate is mottled brown, greyish yellow, and the bristles are greyish white.

Donor—Dr G. Washington Isaac.

[The series of specimens from No. 16 to No. 56 were prepared by Professor John Goodsir from a Rorqual about 35 feet long, which, from the character of the baleen, was *B. musculus*. They were added by him to the Museum.]

16. **Baleen.** Transverse section across the upper lip and one half of the palatal mucous membrane of a Rorqual. Six broad plates are at the outer edge, and internal to these are a number of small, band-like plates. From the mottled, striped appearance of the plates they are evidently from *B. musculus*.
17. **Baleen.** Eight plates from the same Rorqual, with corresponding part of palatal mucous membrane and of the intermediate substance in which the plates are imbedded. The plates are mottled brown, grey, and striped; the bristles are whitish.
18. **Baleen.** A similar section from the same part of the palatal region, showing in addition to the eight plates a number of the smaller plates situated nearer to the mid line of the palate. From the lower border of each plate the bristles project downwards into the cavity of the mouth.
19. **Baleen.** Section through another part of the palate of the same Rorqual, near the middle line. The plates are narrow bands; the lower ends are truncated and give origin to bristles, which, as well as the plates, are white.
20. **Baleen.** A similar preparation to the last. The relation of the intermediate substance to the plates is well seen.
21. **Baleen.** Section through the palatal mucous membrane of the same Rorqual. The plates and intermediate substance have been taken away, and the folds and papillæ by which they are produced are shown.
22. **Baleen.** A fold of the palatal mucous membrane showing three narrow whalebone folds with their characteristic papillæ.
23. **Tympanic** bulla, section of. It has been decalcified and the earthy matter removed. Possibly from a *B. musculus*.

24. **Muscle.** Section through the dorsal muscle of the tail of a Rorqual, *B. musculus*, showing the intermingling of muscular and tendinous bundles.
25. **Tendon.** A transverse section through another specimen from the same animal. The sheath, remarkable for its thickness, has been dissected from the tendon.
26. **Tendon.** A larger example from the tail of the same animal. The sheath can be seen on a part of the surface, but on another part it has been removed, and the subdivision of the tendon into its constituent parallel bundles is displayed.
27. **Tendon.** One of the great tendons from near the end of the tail of a Rorqual, *B. musculus*.
28. **Lip.** Transverse section through the lip of a Rorqual, probably *B. musculus*, showing the folds of mucous membrane adjoining the free edge.
29. **Hair.** Section through skin of the lower lip of a Rorqual, probably *B. musculus*, showing a number of short, coarse hairs projecting from the surface and forming a beard.
30. **Œsophagus,** transverse section from a Rorqual 35 feet long, *B. musculus*, showing longitudinal folding of the mucous lining.
31. **Heart.** Section of auricle of same Rorqual, exhibiting the powerful muscular trabeculæ which project into the cavity, which in places form a reticulated arrangement.
32. **Heart.** Another section through wall of auricle of the same Rorqual.
33. **Heart.** Transverse section of a ventricle of the same Rorqual, showing the reticulated arrangement of the muscular bands.
34. **Heart.** The long fibrous moderator band, connected at its ends with opposite walls of the left ventricle, of a large Rorqual.
35. **Heart.** One half of a semilunar valve of Rorqual, showing the arrangement of the strong fibrous bundles which, springing from its attachment, radiate into the substance of the valve.
36. **Heart.** Cusp of right auriculo-ventricular valve of Rorqual, *B. musculus*, showing two columnæ carneæ and the attachment of the chordæ tendineæ.

37. **Aorta.** Transverse section of the abdominal aorta of the Rorqual 35 feet long; the diameter of the lumen is 4 inches.
38. **Lymphatic** trunks, three in number, converging to join the thoracic duct. They are inverted to show the lining membrane and the semilunar valves.
39. **Lymphatic** trunk, inverted, from the lower part of the abdomen of the same Rorqual; the lumen is more than half an inch in diameter.
40. **Skin.** Section from the skin of the back of the same, showing the subjacent blubber.
41. **Skin.** Section of cutis vera of the same Rorqual. The cuticle has been removed and the closely set papillæ of the cutis are exposed. The papillæ rest upon the dense fibrous structure of the cutis.
42. **Skin.** Horizontal section of dorsal fin of Rorqual. In the middle of the section is the cutis vera, from which the papillæ project into the thick cuticle.
43. **Skin.** Perpendicular transverse section showing a similar structure.
44. **Skin.** Transverse horizontal section of the anterior margin of the dorsal fin of the same animal, showing similar structure.
45. **Skin.** Section through the caudal fin of a Rorqual, *B. musculus*, showing the dense fibrous structure of the cutis vera.
46. **Skin.** Cuticle of a Rorqual, probably *B. musculus*, showing the rich black colour of the deep surface.
47. **Skin.** Cuticle of the abdomen of the same Rorqual, showing its grey colour mottled with brown spots.
48. **Skin.** Superficial part of the cuticle of the same Rorqual, feebly pigmented.
49. **Skin.** Portion of cuticle of a Whale, species not named. It consists of two layers not strongly pigmented, and extending through it is a white band, probably a cicatrix.
50. **Eyeball** of a large Rorqual in antero-posterior section through the optic nerve and the vascular connective tissue which surrounds it. The retina is seen lining the chamber for the vitreous humour. The great thickness of the sclerotic behind and its decrease in front are exhibited.

51. **Eyeball**, anterior segment of a transverse section of a large Rorqual, showing the great thickness of the sclerotic and the sections of two tubes through which the long ciliary arteries pass.
52. **Eyeball**, posterior segment of the same Rorqual, showing the foramina of transmission of the short ciliary arteries and nerves, and a transverse section through the optic nerve.
53. **Eyeball** of the Rorqual, *B. musculus*. An antero-posterior section has been made through the axis of the optic nerve; the great thickness of the posterior part of the sclerotic coat is shown.
54. **Eyeball**. Antero - posterior section through sclerotic, cornea, iris, and choroid. The pigment layer has been removed from the choroid to show its fibro-vascular layer.
55. **Eyelids** of a small Rorqual with the palpebral fissure.
56. **Penis**. Transverse section through the penis of a large Rorqual, probably *B. musculus*; transverse diameter $9\frac{1}{2}$ inches, dorso-ventral diameter 8 inches. The corpora cavernosa are blended; the fibrous coat is $2\frac{1}{2}$ inches thick; the erectile cavernous part is 7 inches in transverse diameter. The corpus spongiosum projects on the ventral surface, and the transverse diameter of the urethra is $1\frac{1}{4}$ inch.
57. **Pennella balænopteræ**, a crustacean parasitic on *B. musculus*, obtained September 1903. Described by Sir Wm. Turner, *Trans. Roy. Soc. Edin.*, vol. xli., 1905. See Pathological Catalogue of the University Museum, section on parasites, p. 397.

Donor—Mr Christopher Castberg.

(2) BALÆNOPTERA SIBBALDI. (BPT. S.)

(Sibbald's Rorqual, Blue Whale.)

Balæna tripinnis quæ maxillam inferiorem rotundam et superiore multo latiore habuit, *R. Sibbald, Phalainologia nova, Edinburgh*, 1692.

Balæna maximus borealis, *Knox, Cat. Mus.*, 1838.

Physalus sibbaldii, *Gray, P.Z.S.*, 1847.

Balænoptera sibbaldii, *Flower, Van Beneden, Turner, and others.*

Balænoptera musculus, sulphur bottom, *True, Smithsonian Contributions*, vol. xxxiii., 1904.



Colour on dorsum of head and body dark steel-grey or bluish black, sides mottled with white, ventral surface with large patches of silver-grey and white. Length from 70 to 80 feet or upwards; dorsal fin at three-fourths of length of animal, falcate; baleen black; outer border of upper jaw with a convex curve, rapidly curving inwards at the tip.

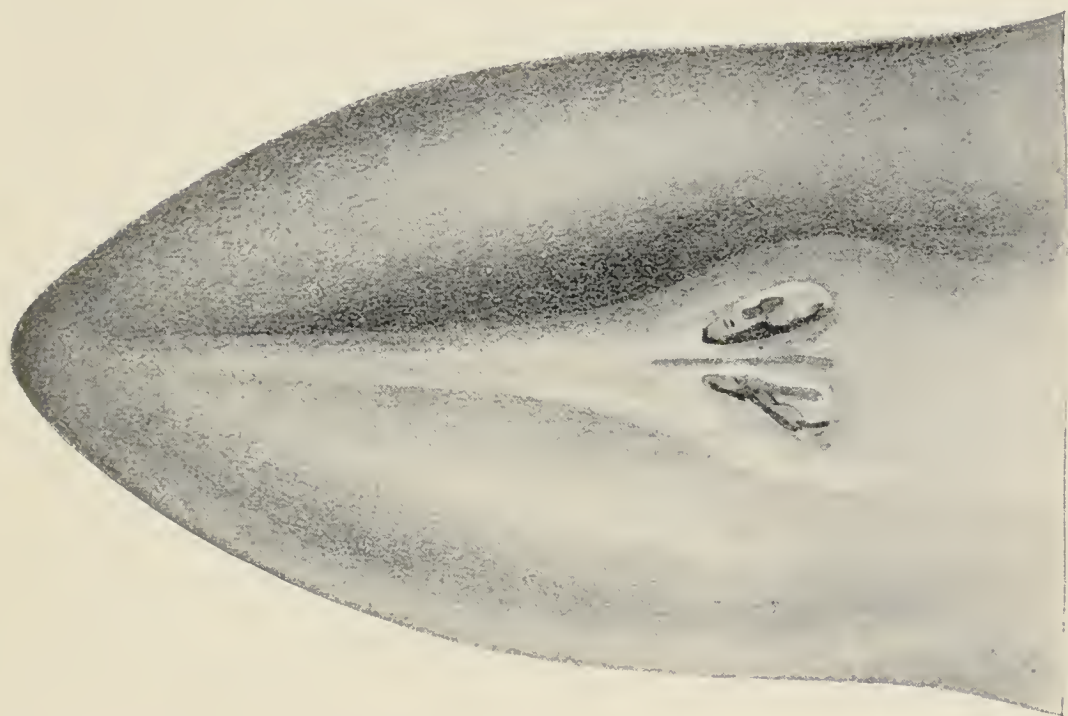
1. **Cranial** cavity, cast of, from a male, 78 feet long, stranded at North Berwick in October 1831: prepared by Robert and Frederick Knox, and at one time in their Museum. The cavity measured in vertical depth $9\frac{1}{2}$ inches, antero-posteriorly 11 inches, and the breadth was 20 inches. The cast gives the general form of the Cetacean brain, the hemispheres, the rhinencephalon, cerebellum, the medulla oblongata, and on each side an irregular-shaped mass which occupied the cranial cavity in the region of the meatus auditorius internus. The skeleton of this whale is suspended in the Royal Scottish Museum, Edinburgh.
Knox Collection, No. 23.

2. **Baleen** plate, somewhat injured, from the Rorqual stranded at North Berwick, 1831. It shows the characteristic black colour of the whalebone in *B. sibbaldi*, and the coarse black bristles which project from the inner border.
Knox Collection.

[No. 3 and the other bones to No. 8 in this Catalogue are from the Great Fin Whale, a gravid female, 78 feet 9 inches long, stranded at Gosford Bay, Longniddry, Firth of Forth, November 1869. It was purchased by an oil merchant, and towed across the

Firth to Kirkcaldy, where it was flensed. The animal was described by Professor Sir Wm. Turner, *Proc. Roy. Soc. Edin.*, December 1869, and more fully in the *Transactions*, vol. xxvi., 1870. The bones of the skeleton in the Museum were presented by the Science and Art Department.

The *fœtus*, a male, was 19 feet 6 inches long; the girth behind the dorsal fin was 3 feet 6 inches, the height of that fin was $6\frac{1}{2}$ inches, and the length of the pectoral limb was 3 feet 7 inches. Figure below shows the dorsum of the beak, its curved convex outline, the dorsal mesial ridge, and the form and direction of the blowholes.]



3. **Mandible** of Sibbald's Rorqual, Longniddry; the halves are not fused at the symphysis. Length along the convexity is 21 feet 2 inches, and in a straight line 19 feet 5 inches. Coronoid process pointed; girth in front of coronoid 4 feet $2\frac{1}{2}$ inches. The condyl did not articulate directly with the temporal, but was attached to it through a cylindriform column about 3 feet in vertical and 2 feet 3 inches in transverse diameter, which was milk-white in colour, and had a reticulated fibrous structure.

In the *fœtus* a similar cylindriform fibrous mass, but only 5 inches in vertical and 5 inches in transverse diameter, was present; by its ends it was continuous with the periosteum enclosing the condyl of

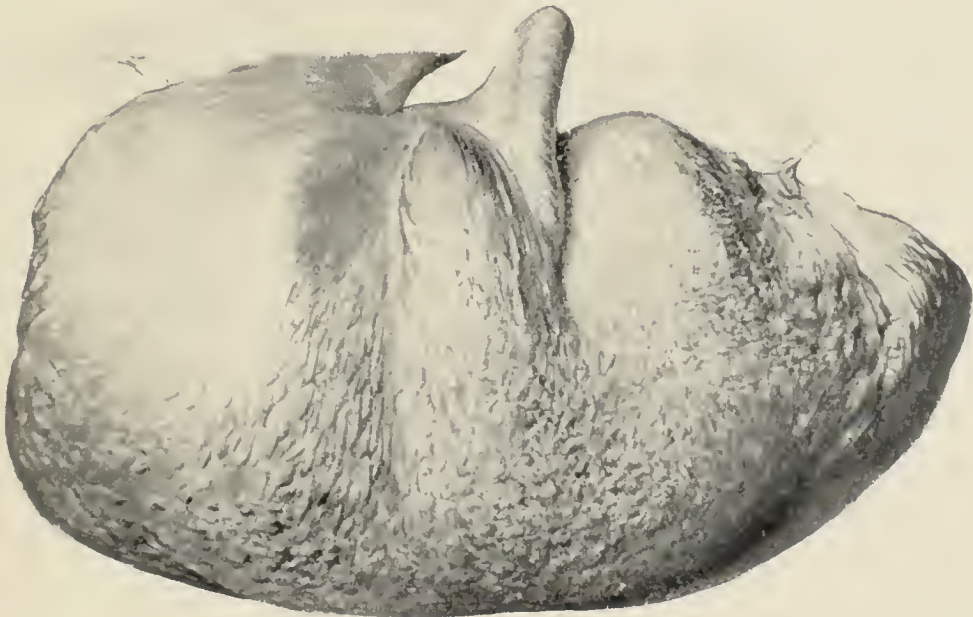
the mandible and with that of the temporal bone above. On vertical section no trace of synovial cavity or articular cartilage was noticed between it and the bones to which it belonged. It formed a suspensory column for the lower jaw, which could be supported by it without the aid of muscles, when the whale was feeding with the mouth open. Figure below.



- 3A. **Skull**, much injured. Beak characteristic in form, length 12 feet 6 inches, breadth 7 feet; from foramen magnum over vertex to tip of beak 20 feet 3 inches; breadth at tip of beak 7 inches: between the orbits 9 feet 3 inches; measures of occiput, see Introduction, p. 6. Longniddry whale, figure, p. 40.
4. **Nasal** bones of the same animal, showing long spur-like process from outer border; faint ridge on inner border; upper surface convex from behind forwards, sloping rapidly downwards and forwards: long diameter of each bone $18\frac{1}{2}$ inches, greatest transverse diameter $6\frac{1}{2}$ inches.
5. **Tympano-periotic** bones, left, of the same, fused together: the tympanic ossicles are present. Length of tympanic $5\frac{1}{4}$ inches, breadth $2\frac{3}{4}$ inches, height 3 inches. The outer surface, strongly convex from above downwards and from before backwards, consists of two divisions separated by a short, moderately wide groove; the posterior extends 3 inches from the groove, and the anterior $2\frac{3}{4}$ inches. The lip-like process projects upwards, and is separated from the rest of the posterior lobe by a much narrower groove.

The inner surface, moderately convex, is marked with striae, which deepen as they turn into the cavity. The lower aspect has a strong keel, which is defined externally by a shallow depression extending parallel to it. The cavity opens at the thick, rounded, horizontal upper border of the inner surface $2\frac{1}{8}$ inches above keel; Eustachian end faintly notched.

Periotic, smooth on its lower surface, is 3 inches long by 2 inches broad; internally are the auditory and other foramina; externally it forms the inner wall of the tympanic cavity. The malleus is attached to the base of the lip-like process. Outer and inner surfaces of the tympanic bone figured below.



6. **Tympano-periotic** bones, right, separate, from the same Whale. They correspond in characters with the left bones.
7. **Tympano-periotic** bones, fused together, from the right and left sides of the *fœtus* of the Longniddry *B. sibbaldi*, each with the malleus and stapes. Tympanic length $4\frac{1}{4}$ inches, breadth $2\frac{1}{2}$ inches, height $2\frac{3}{4}$ inches. They resemble the adult in form, but are smoother, especially in and near the keel-like ridge.
8. **Incus** detached from the left tympanic of *fœtus* of the Longniddry Rorqual.
 [Nos. 9 to 14 are baleen plates from the Longniddry specimens, and their characters and structure are described by Turner in *Trans. Roy. Soc. Edin.*, vol. xxvi., 1870.]
9. **Baleen.** Two plates, 48 inches long and 17 inches wide. Colour black, with coarse black bristles.
10. **Baleen.** A block of "intermediate substance" with narrow blades of baleen stripped off the palate of the Longniddry *sibbaldi*. The blades are dark brown in colour, and the bristles are of a somewhat lighter shade. By the action of spirit, in which the preparation is mounted, and of the light, a partial bleaching of the original black has taken place.
11. **Baleen.** A similar preparation of seven plates with intermediate substance from the same animal.
12. **Baleen.** Another portion of the same wreath from about its middle.
13. **Baleen.** The pharyngeal end of the left baleen wreath of the *fœtus* of the Longniddry *sibbaldi*. Colour slate-grey; bristles very fine, cream-coloured.
14. **Baleen.** A portion of the mucous membrane of the palate of the *fœtus* of the Longniddry *sibbaldi*. Rows of folds of mucous membrane of different sizes, adapted to the origin of both broad and narrow plates, are shown.
 [Nos. 15 to 24 are portions of the skeleton of the Longniddry *B. sibbaldi*.]
15. **Hyoid** bone of female; body and cornua fused together, convex forwards, concave backwards; cornu swollen about the middle; diameter in straight line between tips of cornua 4 feet 7 inches, antero-posterior of body

a



b



c



Balenoptera sibbaldi.

a, front, and *b*, back of atlas ; *c*, axis vertebra.

[To face p. 45.

17 $\frac{1}{4}$ inches; stylohyoid separate, in straight line, 26 $\frac{1}{2}$ inches, flattened on surface. See figure below.



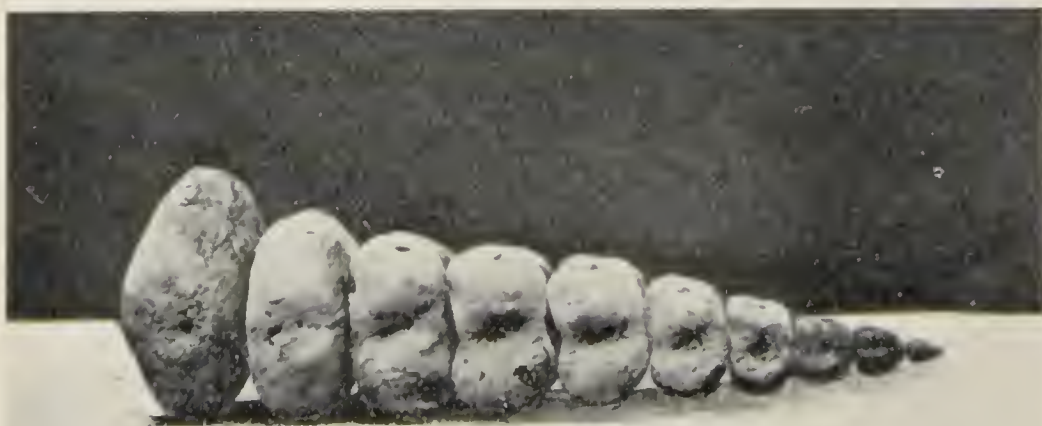
16. **Vertebræ**, cervical, seven, not fused, plates not ossified to bodies. Vertebral formula $C_7D_{15}L_{15}Cd_{26} = 63$. Plates II., III. The *fœtus* had the same formula.

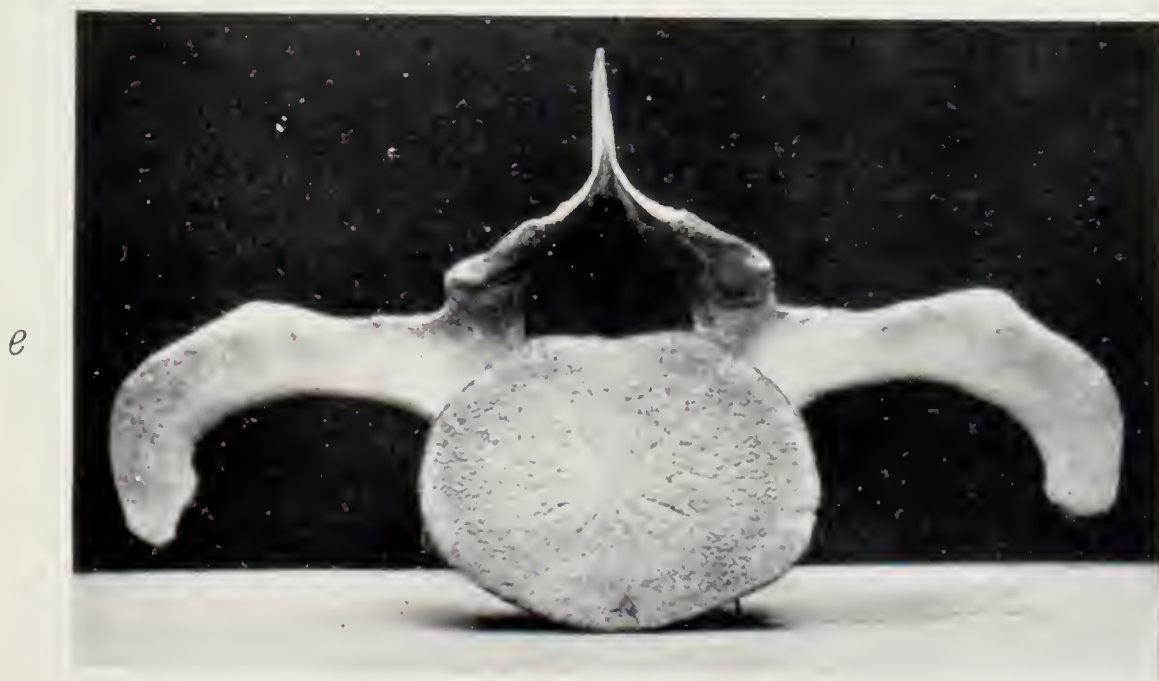
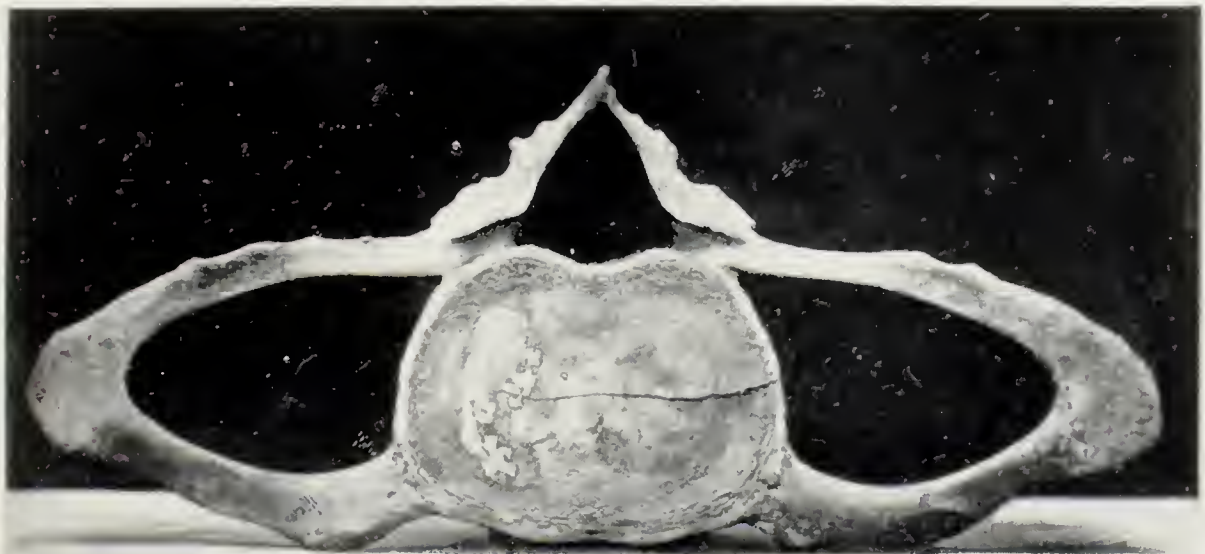
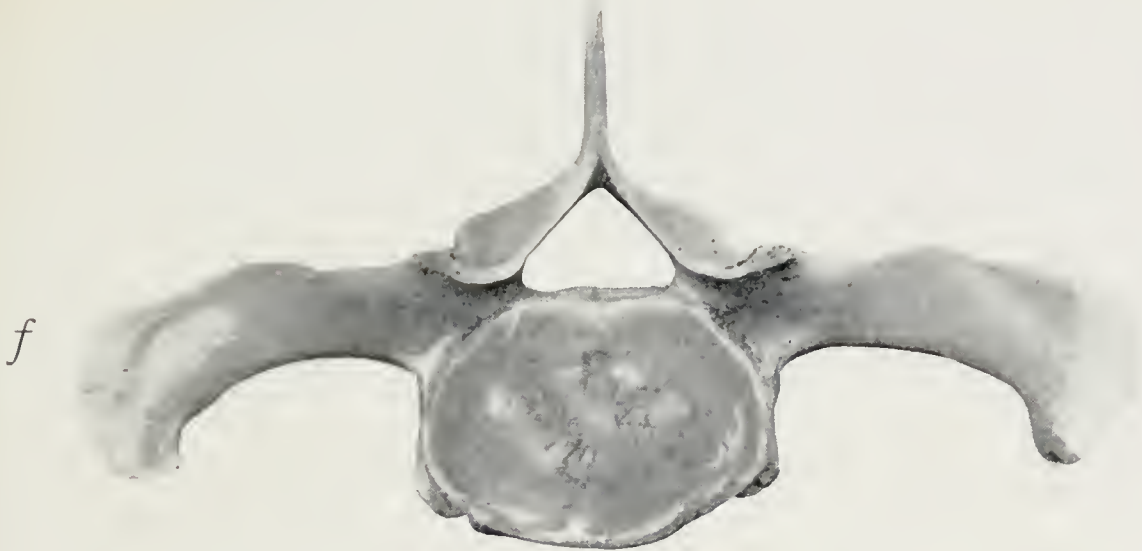
The atlas of the female is 3 feet 2 inches in transverse diameter. The anterior surface has two smooth concave areas for the occipital condyls, separated in part by rough bone and in part by a deep notch continuous with the neural canal, but occupied by a strong ligament which is connected with the stunted odontoid. The upper part of the canal for the cord is 4 $\frac{3}{4}$ inches wide, and only 2 $\frac{1}{4}$ inches in vertical diameter. The posterior surface has a large crescentic articular area for the axis. The neural spine is stunted; the laminae are strong and flattened, and pierced by a foramen for the sub-occipital nerve. On each side is a strong transverse process, triangular, and with a pointed end, but not perforated by a lateral foramen. The axis is 3 feet 8 inches in transverse diameter. The anterior surface has a large crescentic articular area for the atlas, and the concavity of the crescent is roughened for the stunted odontoid. The neural spine is massive; the transverse process, broad and flattened, consists of a parapophysis and a diapophysis united at their outer ends and enclosing a large lateral foramen. The 3rd to the 6th vertebræ have flattened bodies, with a moderate neural arch and spine and a triangular neural canal. The transverse processes are long and slender; the two divisions unite externally and enclose a very large lateral

foramen which contained a great rete mirabile. The 7th cervical differed from the 6th in the transverse process being formed only of the diapophysis or that which springs from the neural arch, the parapophysis being represented by a stunted tubercle on the side of the body. See Plates II., III.

In the *foetus* the atlas had cartilaginous neural arch, body, and transverse processes, though an ossific centre had formed in the ring between the two anterior articular areas. The diameter was 12 inches between the tips of the transverse processes. The cartilaginous body of the axis contained a thick osseous nodule which corresponded with the future odontoid and with the attachments of the check ligaments. Each half of the neural arch had its ossific nodule. The transverse processes were cartilaginous, and the diameter between their tips was $14\frac{1}{2}$ inches. In the 3rd to the 6th cervical the centre of each cartilaginous body contained an osseous nodule about $3\frac{1}{2}$ by $3\frac{1}{4}$ inches. The neural arches were cartilaginous, and in each half a plate-like bar of bone had formed. The large lateral foramina associated with the transverse processes were complete, and their boundaries were formed of cartilage. Between the axis and body of the 3rd vertebra, and between the bodies of the other cervicals, large cavities containing synovia were found, similar to those in the intervertebral discs of the adult.

17. **Vertebræ**, twenty of the more posterior caudals, with nine chevron bones, from the same Finner, mounted in serial order. The ten terminal caudals are shown in the figure below.





Balaenoptera sibbaldi.

d, 4th cervical ; *e*, 7th cervical ; *f*, 1st dorsal.

[To face p. 46.

18. **Chevrons**, six of the anterior, from the same Finner.

In the *fetus* twenty-one chevrons were counted: one was almost exclusively cartilage; four were mostly cartilage; sixteen had a larger proportion of bone. They were attached to the ventral surface of the intervertebral discs. The chevron cartilage was enclosed in its own perichondrium, and was not continuous with the cartilage of the spine. A centre of ossification had formed in the cartilage plate on each side and extended into the mesial plate to form the ventral spine, except that in the last six the lateral plates lay in distinct perichondrial sheaths and did not meet mesially. The chevrons extended as far as the fourth vertebra in front of the tip of the tail, and the last was only $\frac{1}{2}$ inch by $\frac{1}{4}$ inch in diameter. The 1st was smaller than the 2nd, each plate of which was 2 inches long by $1\frac{1}{2}$ inch wide at its attachment to the intervertebral disc. Behind the 2nd the chevrons for some distance increased in size, and then diminished at the hinder end of the series.

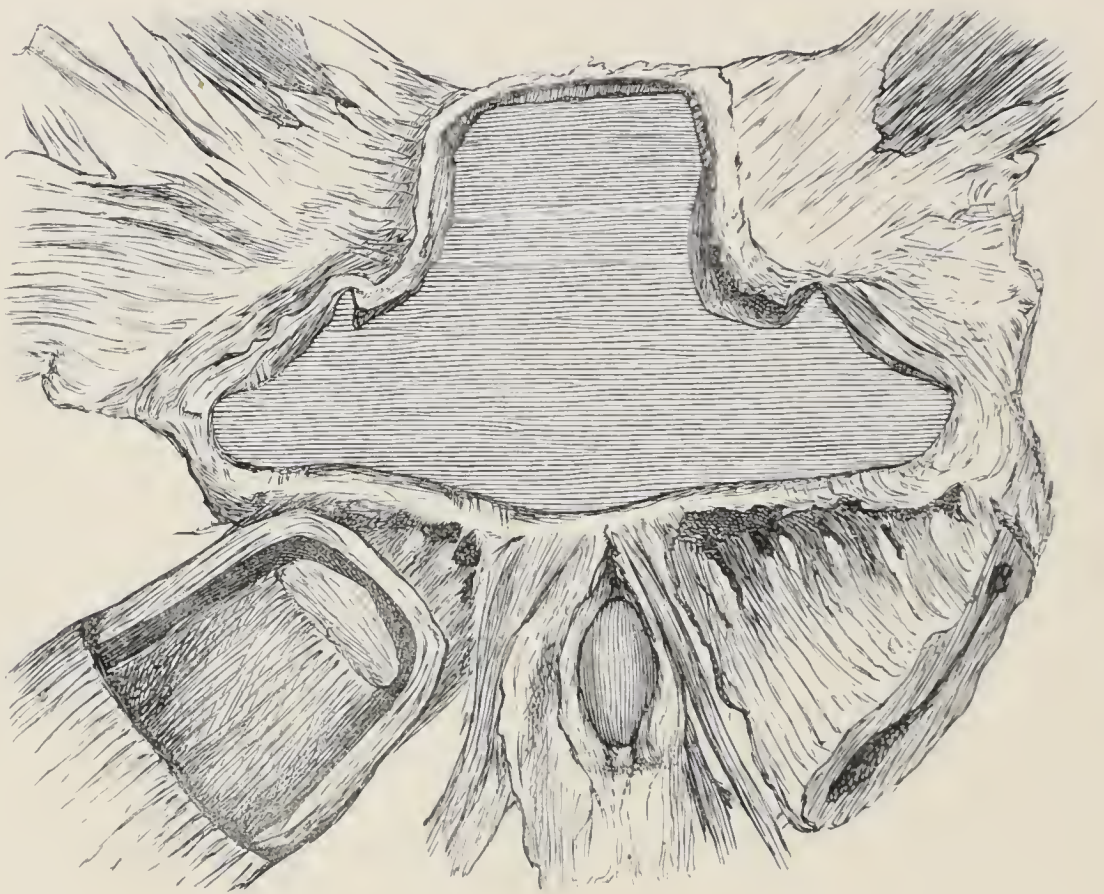
19. **Rib**, last left, and vertebral end of last right rib; left 3 feet 3 inches long, slightly curved; chord of arc 3 feet $1\frac{1}{2}$ inch.

20. **Thoracic** inlet bounded by the Sternum, a cruciform flattened bone with a short posterior limb: transverse diameter $26\frac{1}{2}$ inches, antero-posterior diameter $17\frac{1}{2}$ inches; articulates with 1st pair of Ribs, which also articulate with transverse processes of 1st dorsal



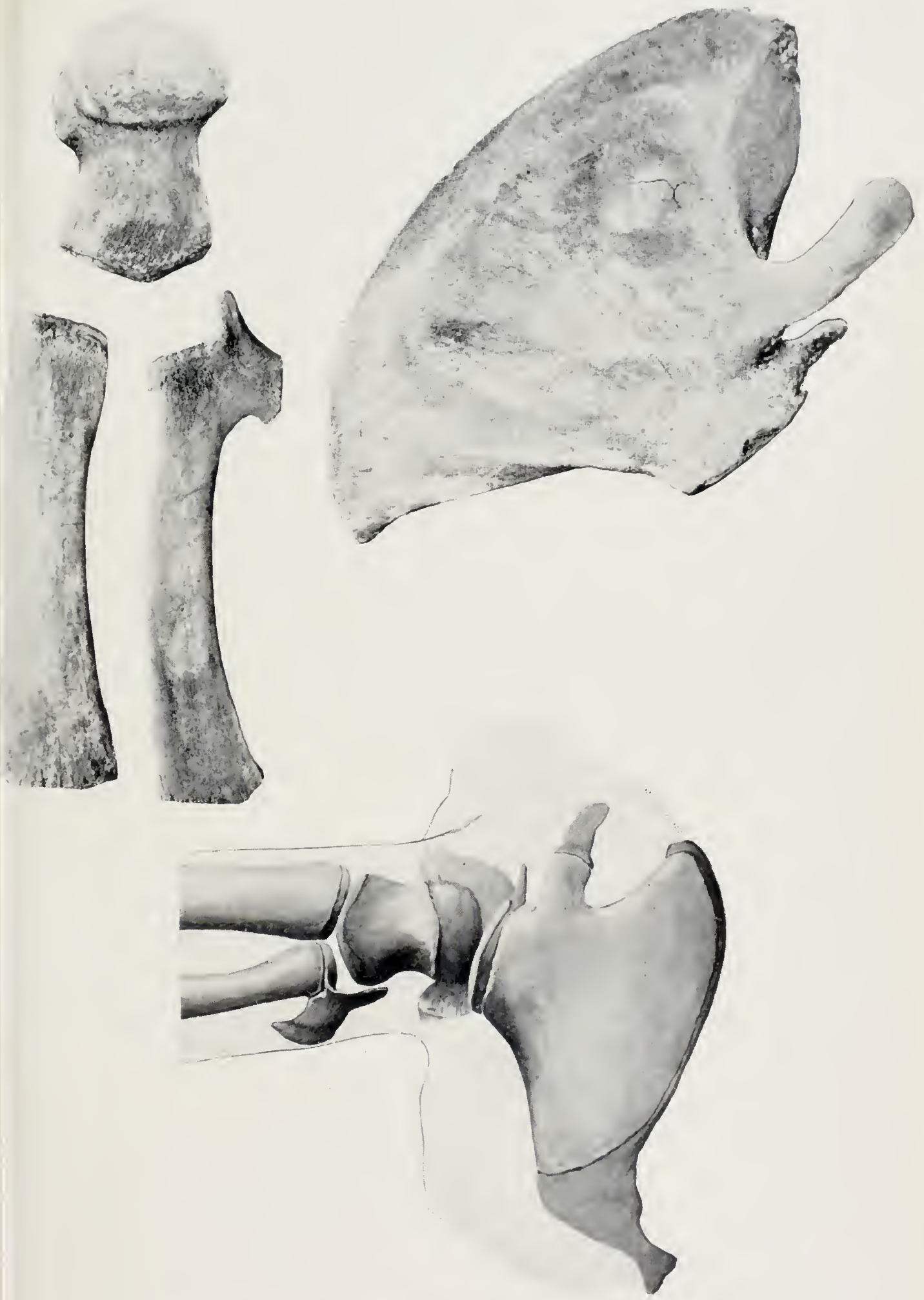
Vertebra; the transverse diameter of the inlet is 4 feet 9 inches, the sterno-vertebral is 3 feet 4 inches.

21. **Sternum** of *B. sibbaldi* from the *fœtus* of the Longniddry specimen. At this stage the sternum consists of two cartilaginous segments, an anterior three-lobed, 5·8 inches in transverse, 3·4 inches in antero-posterior diameter, and an almond-shaped segment 1·1 inch in antero-posterior, and 0·6 inch in transverse diameter. Each segment is enclosed by its perichondrial envelope. Described by Turner in *Journ. Anat. and Phys.*, May 1870, vol. iv. See figure below.



22. **Pectoral Limb**, articulated skeleton of right, with scapula. Length of scapula between angles 5 feet 7 inches; glenoido-vertebral breadth 3 feet 3 inches; length of acromion 1 foot 5 inches, breadth 10 inches; length of coracoid 9 inches. From head of humerus to tip of third or longest digit 13 feet 1 inch, length of humerus 26 inches, of radius 3 feet 10½ inches, of ulna with olecranon 4 feet 3 inches. See Plate IV.

In the *fœtus* much of the scapula was cartilaginous: a plate 6½ by 4½ inches surrounded the posterior angle, and from it a narrow strip was prolonged on the vertebral border to the anterior angle. The acromion was tipped with a plate 2½ inches long.

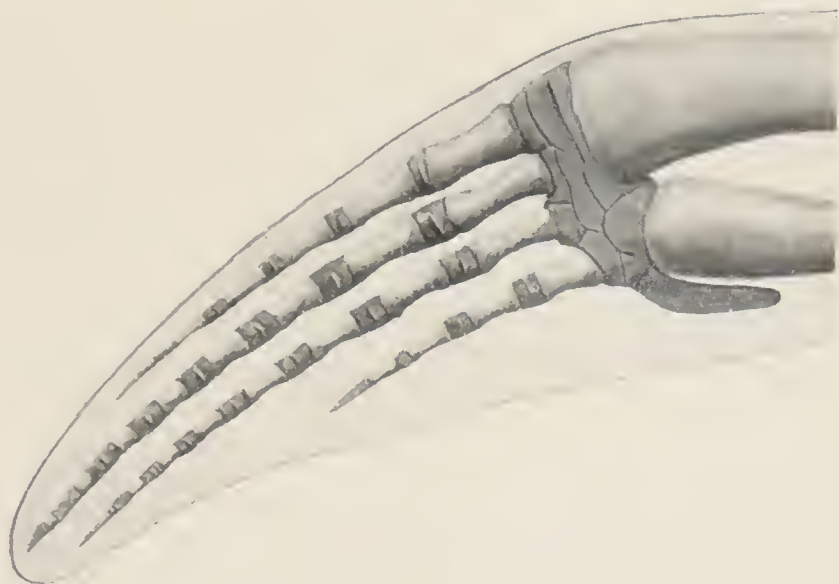


Balenoptera sibbaldi.

Scapula, bones of shaft, adult ; shoulder and elbow, fetus.

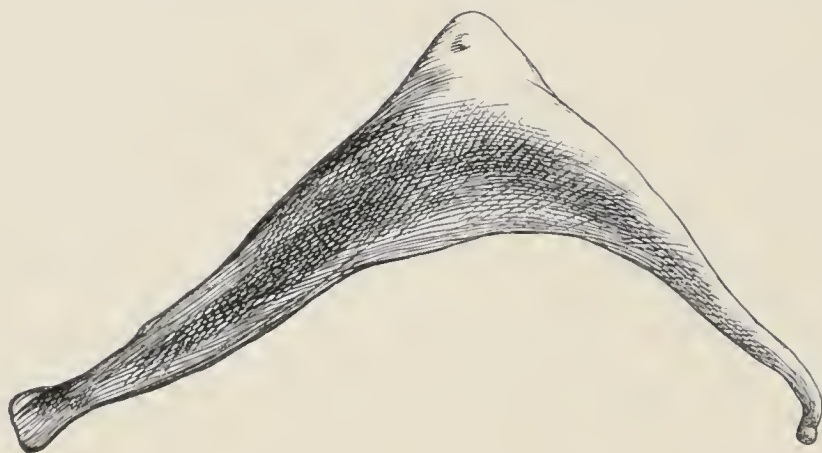
The cartilaginous surface of the glenoid was prolonged into a pointed coracoid. The humerus was $6\frac{1}{4}$ inches long; its head was formed by a thick cartilaginous epiphysis which represented also the tuberosities. The synovial membrane lining the capsule was reflected on to the free surface of the cartilage. The lower end of the humerus also had an epiphysial cartilage with no trace of ossification. The radius with its epiphysis was $15\frac{1}{4}$ inches long, the ulna $14\frac{1}{4}$. The ulnar upper epiphysis was continued into a cartilaginous plate 5 inches by 2 inches which formed the olecranon. See Plate IV.

At the carpal end the cartilaginous epiphysis of the radius was distinct, that of the ulna was fused with two of the carpal cartilages. The cartilaginous mass of the carpus was subdivided by furrows which lodged bands of fibrous tissue that marked off its segments. In the proximal row were radiale, intermedium, and ulnare; the radiale was large, and perhaps included a non-differentiated distal carpale; the ulnare was only partially differentiated by a furrow, and entered into the large cartilage continuous with the ulnar epiphysis and the pisiform, the latter of which formed a band parallel with the inner border of the lower end of the ulna. In the distal row a long cartilage was opposite the carpal ends of metacarpals iii. and iv., and doubtless represented C_{3+4} ; in the absence of the pollex there was no C_1 , and no carpalia were differentiated for M ii. and M v. The four digits were ii. to v. Each had an ossified metacarpal with carpal epiphysis

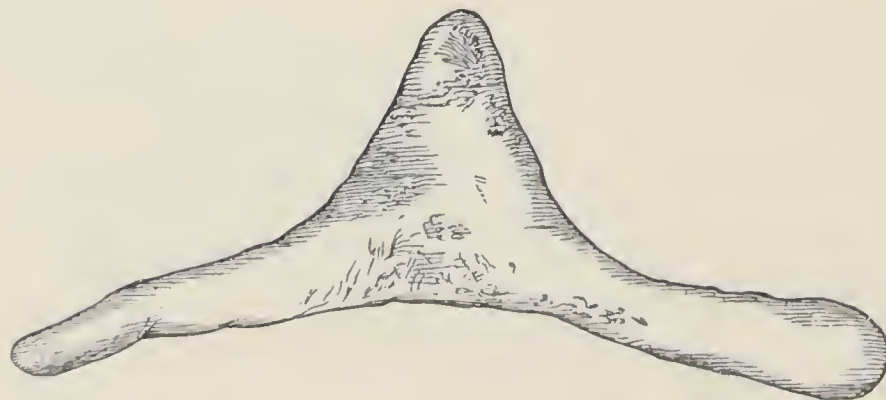


unossified. D ii. consisted of M and Ph₅; D iii. of M and Ph₇; D iv. of M and Ph₇; D v. of M and Ph₃. In each digit the osseous phalanges were united by intervening cartilage divided into a distal epiphysis for one bone and a proximal epiphysis for the other. Each digit ended in a terminal rod of cartilage in which possibly one or more additional phalangeal ossifications might have formed. See Plate IV. and figure, p. 49.

23. **Carpal** and metacarpal bones and phalanges, not articulated, from the older Longniddry Finner.
24. **Pelvic** bones, pair from female; there was no appearance of a rudimentary femur. Each bone consists of a short process and of two long processes, and is 17 inches between the tips of the long processes. Figure below.

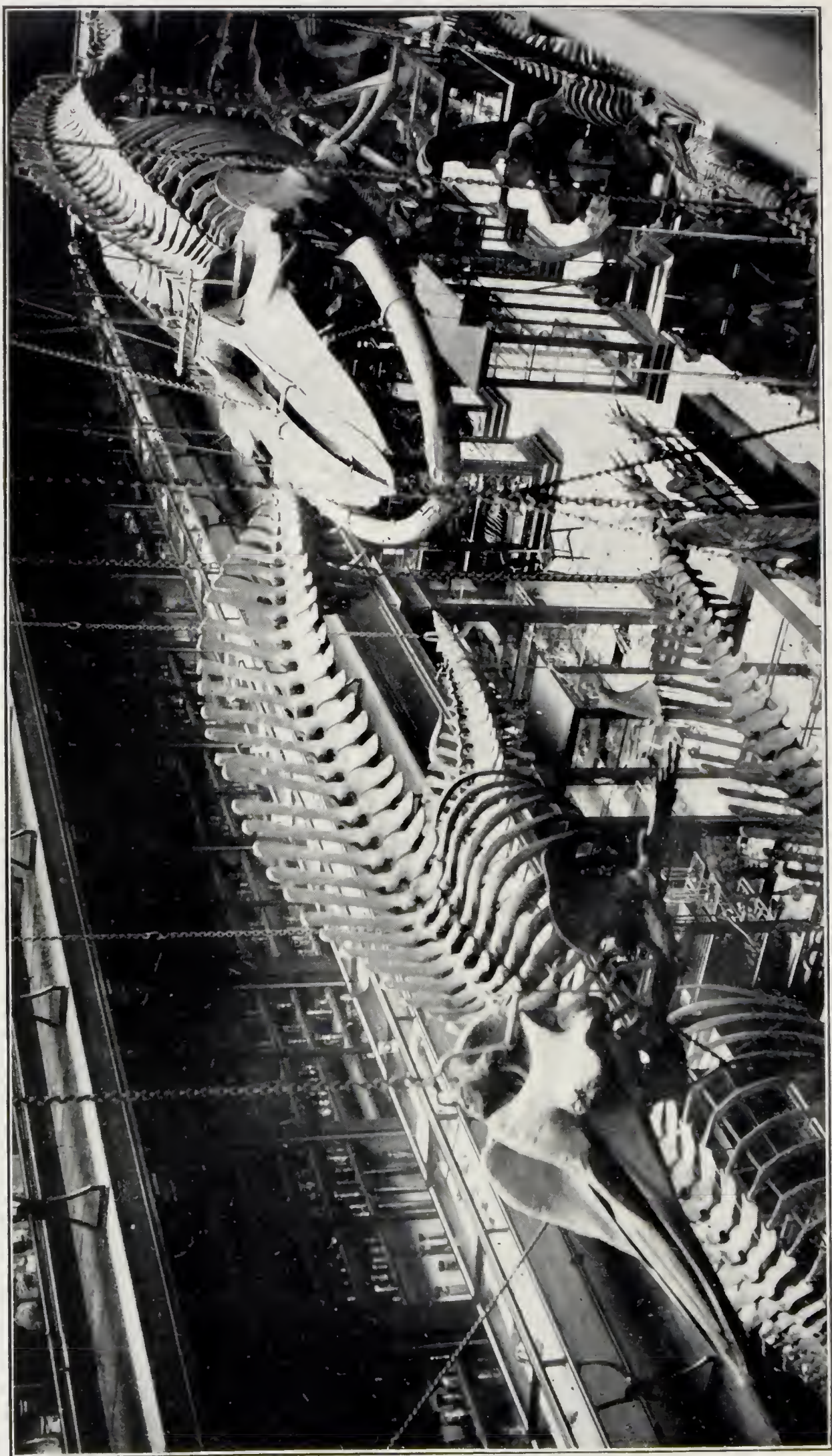


In the *fœtus* the pelvis was cartilaginous, 3·9 inches between the tips of its long processes. The crus penis and erector muscle were attached to the posterior process. Described by Turner in *Journ. of Anat. and Phys.*, May 1870, vol. iv. Figure below.



[Nos. 25 to 47 are from the Turner Collection.]

25. **Skeleton**, articulated, *B. sibbaldi*, Wick: caudal vertebræ absent. Baleen plates *in situ*. The whale, a female,



Balenoptera sibbaldi.

Hyperoodon.

was 56 feet long; the pectoral limb was about 7 feet long and 22 inches in greatest breadth; the baleen was rich black; the back and sides were black; the belly was furrowed, mottled black and white, grey, or slate-coloured. The blubber on the back was 1 foot thick. Skull 11 feet long in straight line; greatest breadth 5 feet 7 inches; length of beak 7 feet 5 inches; breadth of base of beak 5 feet 3 inches; length of premaxilla 8 feet 7 inches; interval between nasal ends of premaxilla 1 foot; from foramen magnum to upper edge of occipital 2 feet $5\frac{3}{4}$ inches; mandible along outer curve 11 feet 9 inches, chord of arc 10 feet $7\frac{3}{4}$ inches. The whale was taken at Wick in September 1871. See Plate V.

26. **Tympanic** bones, pair of, one broken; length $4\frac{1}{2}$ inches, breadth $2\frac{3}{4}$ inches; height $2\frac{7}{8}$ inches; from the Wick *B. sibbaldi*.

27. **Baleen.** Three plates from the Wick specimen. Length $15\frac{1}{2}$ inches, breadth at base 5 inches. Plates black, bristles brown-black.

28. **Baleen.** Palatal mucous membrane showing the folds from which the plates of baleen grow, and the long papillæ which penetrate the plates. From the Wick *sibbaldi*. Spirit preparation.

29. **Maxilla**, left, superior; length 11 feet 5 inches, greatest breadth 2 feet 5 inches; the outer border has the characteristic contour of Sibbald's Whale. From a whale stranded at Burghead, Moray Firth. The head had been imbedded in a bank of sand.

Donor—Provost Jenkins, through
Mr William Taylor, Lhanbryde.

30. **Nasal** bones, from *B. sibbaldi* 45 feet 2 inches long stranded at Aberdour. Spur-like process rudimentary; long diameter of upper surface of each bone 11 inches, greatest transverse diameter $2\frac{3}{4}$ inches. The whale's throat was plicated; a falcate dorsal fin was present; the back was bluish black in colour; the sides and venter silvery white; the baleen black, the longest blades $2\frac{1}{2}$ feet; length of pectoral limb 5 feet 8 inches; breadth of caudal fin 10 feet 8 inches. See also Nos. 32 and 43.

Aberdour, Fife, July 1858. Donor—Dr J. M'Bain, R.N.

31. **Nasal** bone, left; the antero-posterior convexity of the upper surface is 7 inches. Donor—Mr Jos. Downs.

32. **Tympanic** bone, left, from the Aberdour Finner, July 1858. Length $4\frac{3}{4}$ inches, breadth $2\frac{5}{8}$ inches, height 3 inches. See Nos. 30 and 43.

Donor—Dr Joseph Bell.

33. **Tympano-periotic** bones, fused together, right and left, from Harris. Each periotic is continued into a spur-like mastoid process for attachment $18\frac{1}{2}$ inches long; tympanic ossicles present. One incus detached. Length of Tympanic $5\frac{1}{4}$ inches, breadth $2\frac{3}{4}$ inches, height $3\frac{1}{8}$ inches. Periotic elongated to $3\frac{1}{2}$ inches; inferior surface smooth; meatus large. See No. 37.

November 1905. Donor—Dr Duncan Fletcher, Harris.

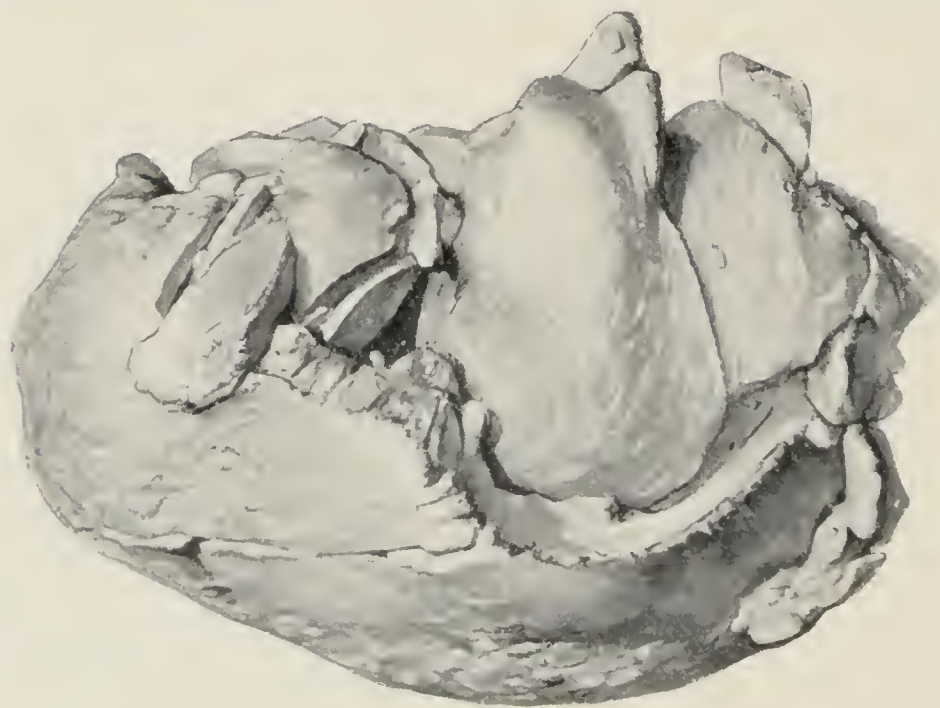
34. **Tympanic** bones, pair of. Length of bone 5 inches, breadth $2\frac{5}{8}$ inches, height 3 inches.

Bergen, 1891.

Purchased.

35. **Tympanic**, left, obtained from a whaling seaman who brought it from the Falkland Islands; said to be from the "Blue Whale," probably *B. sibbaldi*. Length $5\frac{1}{2}$ inches. The tympanic had sustained during life an extensive comminuted fracture of the outer surface of the bone which had been partially repaired. See figure below.

Donor—Sir Wm. Turner, 1911.



[The specimens marked "Hanna Voe" were obtained through Messrs John and Thomas Anderson, of Hillswick, Shetland.]

36. **Baleen**, two plates of *B. sibbaldi* from the Hanna Voe Finner, 1869: length 35 inches, width 12 inches. Colour black, with strong black bristles.

37. **Baleen** plate of *B. sibbalði*; length 39 inches, width 16 inches; from Harris, Long Island, 1905. Colour, form, and texture as in the other specimens. See No. 33.

Donor—Dr Duncan Fletcher.

38. **Baleen** plate from *B. sibbalði* from Eide, in the Faroe Islands; length 46 inches, width $18\frac{1}{2}$ inches. Colour, form, and texture as in the other specimens.

Donor—J. A. Harold Brown, Esq.

39. **Baleen**, two plates taken from a calf of the Steypireythr (*B. sibbalði*) by Captain Bottemann, May 1871. The plates are 7 inches long and $2\frac{1}{4}$ inches wide at base. Colour of plates and bristles greyish white.

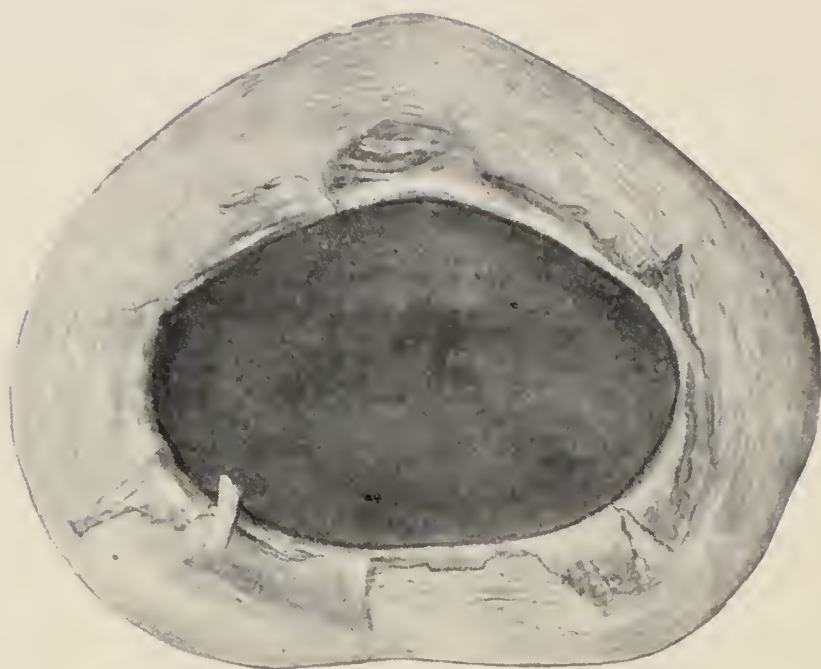
Donor—Captain Bottemann.

40. **Vertebræ**, seven Cervical and first Dorsal, with inter-vertebral discs dried and shrunk; natural skeleton. The plates are partially ossified to the bodies. The length of the cervical part is 3 feet 2 inches; the greatest transverse diameter at the axis is 4 feet 6 inches. The range of rotation of the atlas on the axis was 17° . The odontoid is stunted, and was imbedded in a thick, strong ligament occupying a part of the ring of the atlas, which acted as a check to prevent over-rotation in either direction. A slight rocking movement of the atlas on the axis was also permitted. The cervicals in this animal closely resembled those in the Longniddry whale, except the 6th cervical, in which the diapophysis was complete, whilst the parapophysis was only 10 inches long, ended in a point, and did not complete the boundary of the lateral foramen. The first dorsal resembled the seventh in its parapophysis being represented by a stunted tubercle. The specimen is from a gravid female, said to have been about 90 feet long, but not measured, stranded in October 1869, near Hamna Voe, Shetland. Referred to by Turner in *Trans. Roy. Soc. Edin.*, vol. xxvi., 1870.

41. **Vertebræ**, eight dorsal, the plates not fused with the bodies, from the same whale.

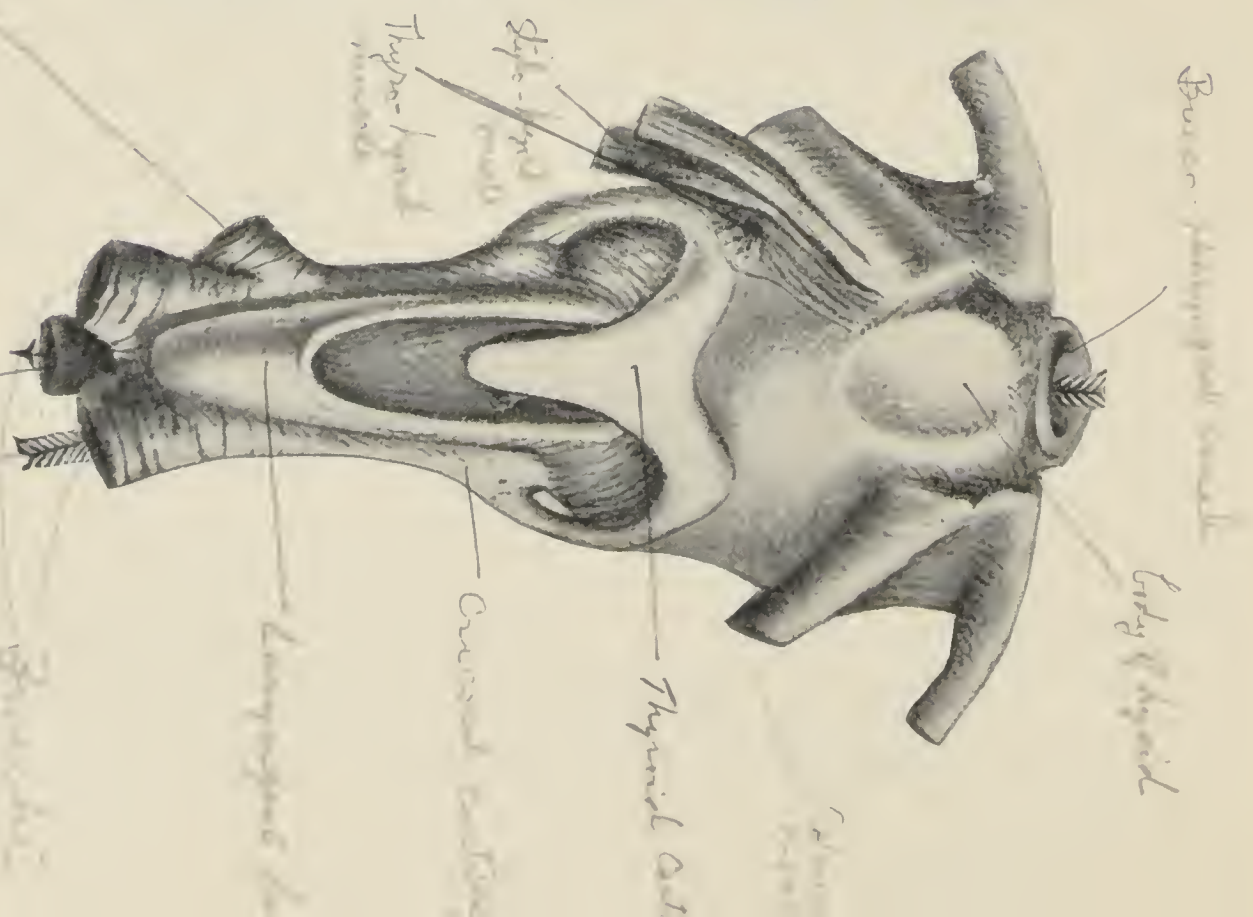
42. **Vertebra**, lower dorsal, the plates not fused with body of vertebra; mounted to show the great central cavity in the inter-vertebral disc, 11 by $7\frac{1}{2}$ inches, lined by a flocculent synovial membrane, which during life is filled with a yellow synovial fluid. The presence of so many synovial joints in the spine, conjoined with the small articular processes, facilitated

the movements of the spine. From the Hamna Voe specimen. See figure below.

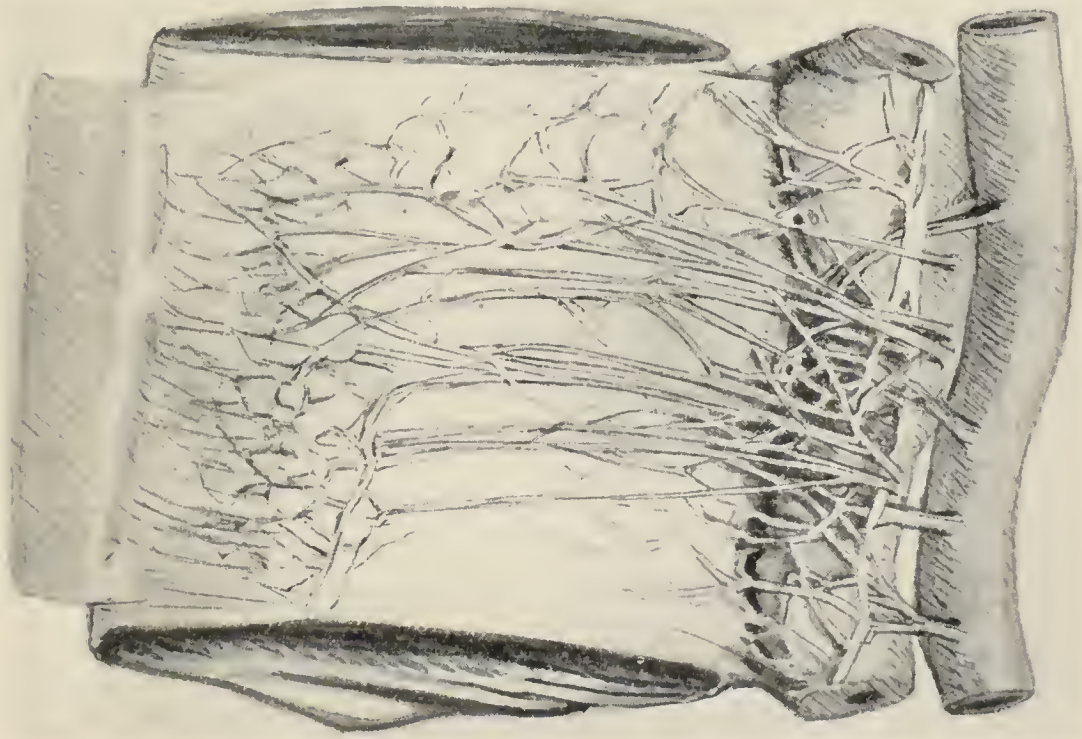


43. **Vertebra**, lumbar, from a *B. sibbaldi* stranded at Aberdour, Fife, July 1858. See Nos. 30 and 32.

44. **Larynx and Hyoid**. Pouch from *fœtus* of Longniddry *B. sibbaldi*, opened to show the mucous lining and follicles. It is at the front of the larynx and extends from the thyroid cartilage to within 2 inches from the bifurcation of the trachea; it communicates with the larynx between the thyroid and cricoid cartilages. Its outer wall is muscular. Turner in *Trans. Roy. Soc. Edin.*, vol. xxvi., 1870. See figure below.



45. **Bronchi** dissected out of the lung of the *foetus* of the Longniddry *B. sibbaldi*. The method of branching, the cartilaginous rings, and the large bronchial nerves which ramify on the wall of the tube and its branches are shown.
46. **Moniliform tube**. A portion of the intestine of the Longniddry *B. sibbaldi*; parallel and next to the mesenteric border is the moniliform tube, external to which is the superior mesenteric vein. The thickness of the wall of the tube and the constrictions on the surface are shown in the figure. See Turner's description in *Trans. Roy. Soc. Edin.*, vol. xxvi., 1870, for probable relations to mesenteric arterial system. See figure below.



47. **Omentum**, portion of, from the Longniddry *B. sibbaldi*, showing its beautiful reticulated character.
48. **Aorta**. Transverse section through the thoracic aorta of the North Berwick *B. sibbaldi* 78 feet long. The transverse diameter of the lumen is $9\frac{3}{4}$ inches; the wall in the fresh state was $1\frac{5}{8}$ inch thick. The section was taken about 3 feet from the origin of the aorta.
Knox Collection, No. 18.
49. **Pulmonary** artery showing a much thinner coat than the aorta. A single semilunar segment of the valve. From a large Rorqual, the North Berwick *B. sibbaldi*.
Knox Collection, No. 21.

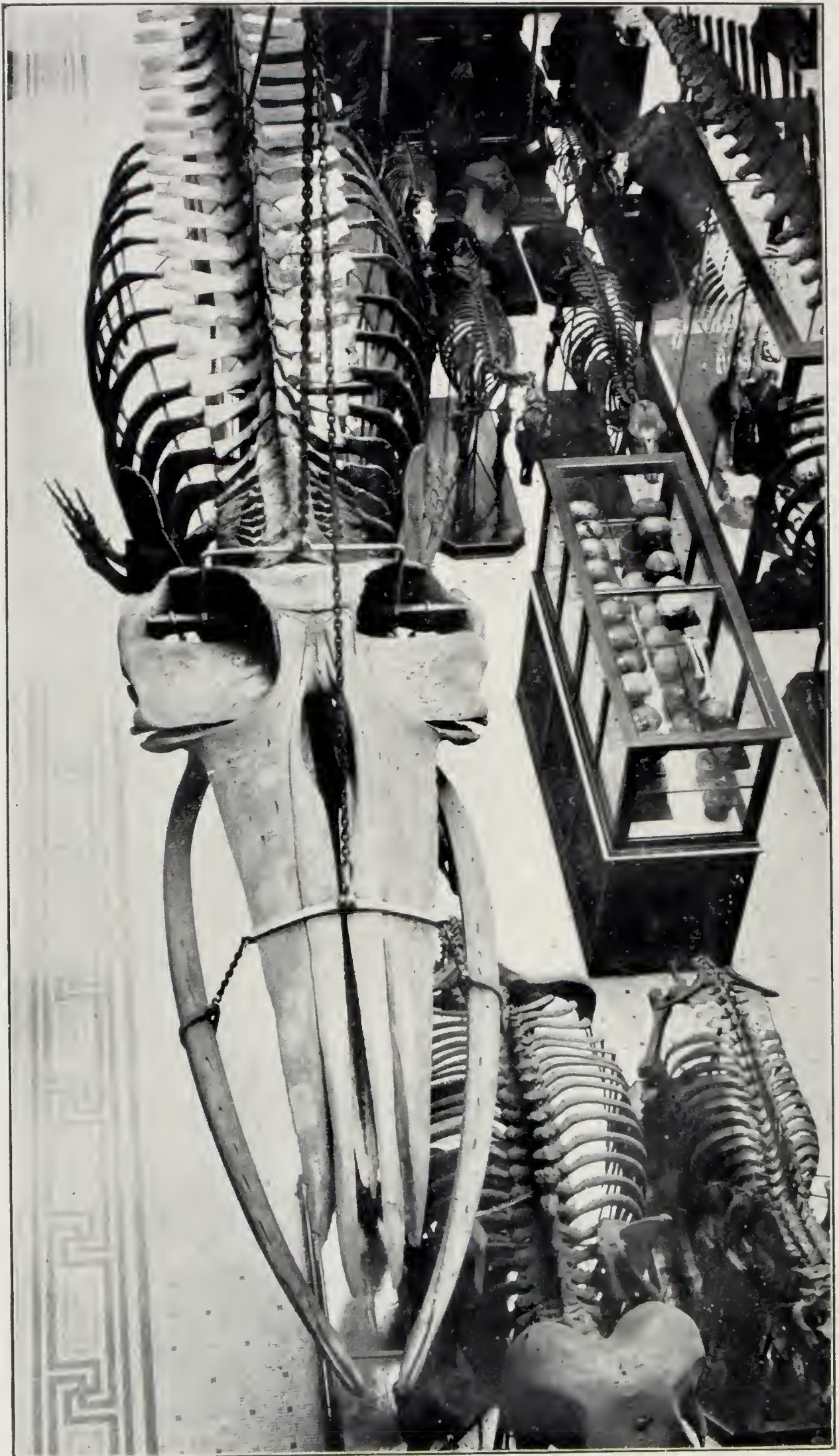
[Nos. 50 to 54 are from the Turner Collection.]

50. **Rete** mirabile. A portion of the rete from the Longniddry foetus. The arteries have been dishevelled to show the convoluted and plexiform arrangement.
51. **Vein**, portal, of Longniddry foetus; the lumen is $2\frac{1}{2}$ inches in diameter; two subordinate veins are continuous with it.
52. **Skin**. Portion of cuticle peeled off the lip of the Longniddry *sibbaldi* which displays its black colour.
53. **Skin**. Portion of skin of the ventral aspect of the Longniddry foetus, showing the characteristic ridge and furrowed plications in the Rorquals.
54. **Skin**. Vertical section through one of the folds of skin of the venter, showing cuticle and cutis.
55. **Eyeball**, left, entire, of the Great Rorqual, *B. sibbaldi*, showing the dissected sclerotic, the attachment of the recti muscles, one half of the cornea, and a portion of the ocular conjunctiva; transverse diameter $5\frac{1}{8}$ inches, antero-posterior $3\frac{1}{2}$ inches. Optic nerve from brain to eyeball said to be 5 feet long; the nerve is surrounded by a vascular rete mirabile.

Knox Collection, No. 24.

[Nos. 56 to 61 are from the Turner series of Placentæ.]

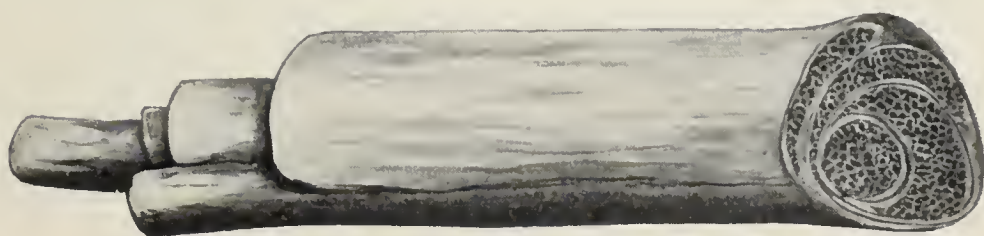
56. **Placenta**. A portion of the chorion of the Longniddry *sibbaldi*, showing the villous surface and one of the great longitudinal ridges, not injected. See *Trans. Roy. Soc. Edin.*, 1870.
57. **Placenta**. A portion of the same chorion, showing a flattened triangular fold, not injected.
58. **Placenta**. A portion of the same chorion, showing villous surface, portions of two longitudinal ridges, and a non-villous area which was probably in relation with the os uteri internum.
59. **Mamma**. Transverse section through the chief duct of the gravid Longniddry *sibbaldi*; the coat averages 1 inch in thickness, and the lumen is about 4 inches in diameter. See *Trans. Roy. Soc. Edin.*, 1870.
60. **Mamma**. One of the large ducts from the same, opened to show the longitudinal folds of the mucous membrane and the openings of some of the smaller ducts.



Balaenoptera borealis.

61. **Vagina**, portion of, from the Longniddry *sibbaldi*, to show the transverse folds of the mucous coat.

[**Tendon**, drawing of, from one of the great muscles of the tail of *B. sibbaldi*. The tendon consisted of thick fibrous laminae, arranged obliquely around a core situated near one side of the tendon. Between the laminae was a looser fibrous tissue, and in the working of the muscle the laminae would seem to move around the core as an axis, which would impart a screw-like movement to the tail.]



(3) BALÆNOPTERA BOREALIS. (BPT. B.)

(Rudolphi's Rorqual.)

Balænoptera borealis, Lesson, *Hist. Nat. des Cétacées*, 1828.

B. laticeps, Gray, *Zool. Erebus and Terror*, 1846.

Sejhval of the Norwegian Whalers.

Colour bluish black on back, belly white with a shade of yellow; length 38 to 45 feet, rarely 50 feet; fourteen pairs of ribs, dorsal fin high. Baleen mostly black, but striped grey and white; bristles white, very fine to the touch. Outer border of superior maxilla and premaxilla proceeding almost straight to tip.

1. **Skeleton**, articulated, hyoid in position; first rib not bicipital. Length of animal 38 feet, of skeleton 35 feet $2\frac{1}{4}$ inches, of skull 8 feet $1\frac{1}{4}$ inch; breadth of skull 3 feet $10\frac{1}{4}$ inches; length of beak 5 feet 9 inches, breadth at base 2 feet 6 inches; mandible length along outer convex surface 8 feet 8 inches. Vertebral plates not ossified to bodies; formula $C_7D_{14}L_{14}Cd_{21}=56$; humerus 11 inches long, radius $20\frac{1}{4}$ inches, ulna $20\frac{3}{4}$ inches. Length of shaft and manus 4 feet $7\frac{1}{4}$ inches. From Kinneil, Bo'ness, Firth of Forth, September 1873. The first specimen to be recognised as a British species. Described by Sir Wm. Turner, *Proc. Roy. Soc. Edin.*, vol. xi., 1882, and *Journ. Anat. and Phys.*, April 1882. See Plate VI.

2. **Tympanic** bones, pair of, from the whale stranded at Kinneil, Bo'ness, September 1872. Length of tympanic 4·8 inches, breadth 2·2 inches, height $2\frac{3}{4}$ inches. Outer surface, anterior division $2\frac{1}{8}$ inches, posterior division $2\frac{7}{8}$ inches; cavity opening horizontally along upper margin of inner surface 2 inches from keel, Eustachian end strongly notched. Figure of outer surface below.

In the description of the whale in *Proc. Roy. Soc. Edin.*, vol. xi., the characters and dimensions of the tympanic are compared with those of *B. rostrata* and *B. sibbaldi*. It differs from *B. musculus* in the outer surface not being so tumid, its anterior border is not defined by a distinct groove, and the inner surface is more flattened. The keel is a narrow ridge, and the adjoining surfaces are laterally compressed.

Turner Collection.



3. **Tympanic** bone, left, with tympanic ossicles, from the Skorö Whaling Station, Norway, 1894. Length $4\frac{3}{8}$ inches, breadth $2\frac{1}{4}$ inches, height $2\frac{5}{8}$ inches. Malleus fused with lip-like process.

Donor—Sir Dyce Duckworth, Bart.

4. **Tympanic** bone, left, from a male, 36 feet long, killed at Widewall Bay, Orkney, 1884. Length $4\frac{3}{4}$ inches, breadth $2\frac{3}{8}$ inches, height $2\frac{3}{4}$ inches. Sir John Struthers in *Reports of British Association, Aberdeen*, 1885, p. 1053. Donor—Sir John Struthers.

5. **Tympanic** bones, pair of, one with ossicles, from New Island, Falklands, South Atlantic; purchased from a

whaling seaman, 1911, who took them from the Sye Whale (Saaiwahl, Sejhval). The bones closely correspond with those of *B. borealis*. Length $4\frac{3}{4}$ inches, breadth $2\frac{1}{4}$ inches. Donor—Sir Wm. Turner.

6. **Tympanic** bone, left; length $4\frac{6}{10}$ inches, breadth $2\frac{4}{10}$ inches, height $2\frac{6}{10}$ inches. Outer surface convex, separated by short wide groove into longer posterior and shorter anterior divisions; inner surface relatively flattened, and with thick upper striated border almost straight; inferior aspect definitely keeled, with its sides laterally compressed, prolonged into a strong posterior border, whilst the anterior end is relatively flat; malleus fused with lip-like process.

Donor—Dr A. Logan Turner, 1912.

7. **Baleen**, two blades; purchased. From a Sye Whale brought into New Island, Falklands, in 1910. Colour mostly black, but striped grey, and with white band at inner border; bristles whitish, slender and delicate. Presumably *B. borealis*.

Donor—Sir Wm. Turner, 1911.

8. **Baleen**, small blades, from the anterior end of wreath of *B. borealis*, stranded at Kinneil, Bo'ness, September 1872, No. 1. Colour dark grey, striped greyish white, with whitish, slender, delicate bristles.

Turner Collection.

(4) BALÆNOPTERA ROSTRATA. (BPT. R.)

(Lesser Rorqual or Pike Whale.)

Balæna rostrata, *Fabricius, Fauna Grænländica*, 1780.

Balænoptera acuto-rostrata, *Lacépède, op. cit.*

Balæna minimus borealis, *Knox, Catalogue of Museum*, 1838.

Colour rich black on back, white and slaty grey on belly, white band where flipper joins side of body. The smallest species of Rorqual, not exceeding 35 feet; eleven pairs of ribs, dorsal fin high. Baleen short, whitish yellow; head flattened, dorsum tapering to a pointed beak. Outer border of superior and premaxillæ straight, not curving inwards at tip.

1. **Skeleton**, natural, of young *B. rostrata*, 9 feet 8 inches long; skull 2 feet 11 inches. Baleen plates about $2\frac{1}{2}$ inches long; dull white. Vertebral formula $C_7D_{11}LCd_{31}=49$. Described in *Catalogue of Knox*

Museum and in *Account of the Dissection of a Young Rorqual*, by R. Knox, who saw eight distinct hairs at the end of snout in each jaw. He proved it to be specifically distinct from the Great Rorqual (*B. sibbaldi*), *Proc. Roy. Soc. Edin.*, April 1834.

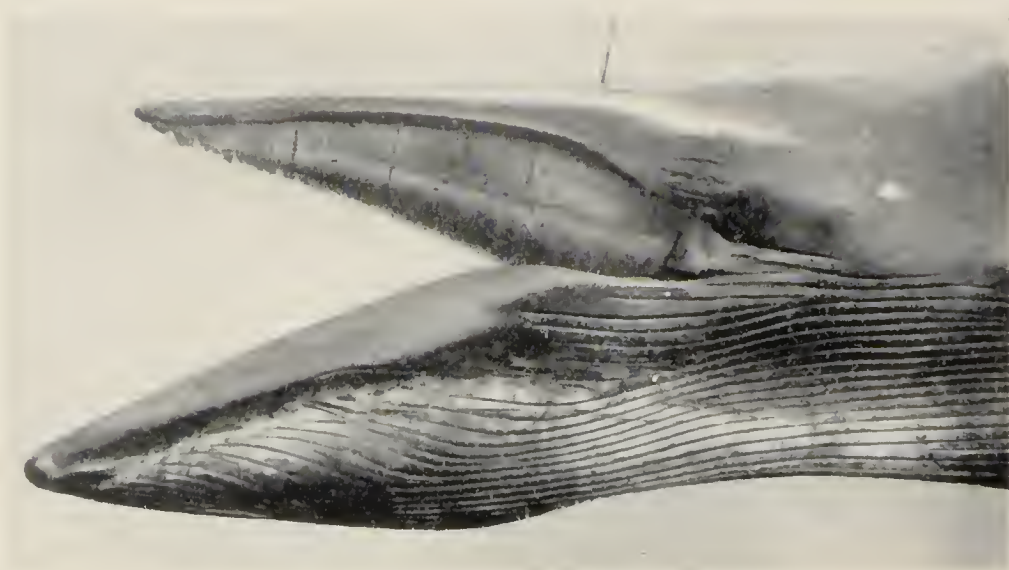
Queensferry, Firth of Forth, February 1834.

Knox Collection, No. 28.

2. **Skeleton**, adult, female, articulated, with dorsal and caudal fins, pelvic bones, hyoid and baleen wreath *in situ*. Dorsal fin 7 feet from mid end of tail. Length of whale in straight line 28 feet 4 inches; length of skull in straight line 5 feet 10 inches; length of humerus $11\frac{1}{2}$ inches, of radius $18\frac{1}{2}$ inches, of ulna 18 inches; length of mandible on convex surface 6 feet $4\frac{1}{2}$ inches; vertebral formula $C_7D_{11}L_{13}Cd_{19}=50$.

Granton, Firth of Forth, January 1888.

Donor—Sir John Murray, K.C.B.



[The Granton specimen (No. 2) was an adult female, and the vertebral plates were ossified to the bodies of their respective vertebrae. It is described by Sir Wm. Turner in *Proc. Roy. Soc. Edin.*, February 1892, vol. xix. Figure above, and Plate VII. In the same memoir measurements are given of its skull and of those of *Bpt. R.*, Nos. 1, 3, 4, 5, 6 in the Museum. Nos. 2 to 22 are from the Turner Collection.]

3. **Skull** of a young female 18 feet long, with mandible. Length of skull 3 feet 8 inches; length of maxilla from notch 2 feet 3 inches, breadth at base of beak 1 foot $2\frac{1}{2}$ inches.

Burntisland, Firth of Forth, September 1870.

Donor—George Prentice, Esq.



Balenoptera rostrata.

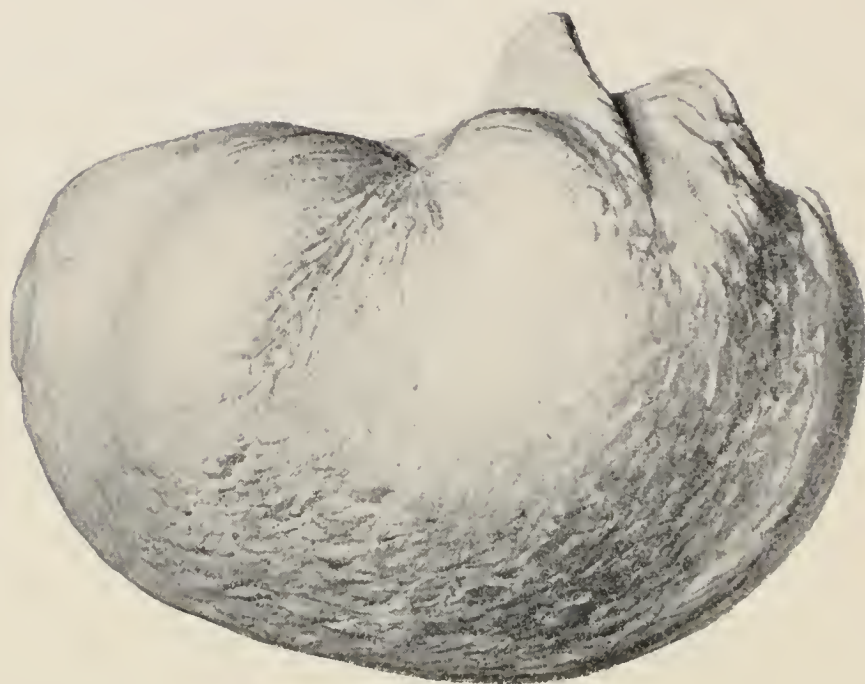
4. **Skull** of a young male 18 feet long, with left half of mandible. Length of skull 3 feet 6½ inches; length of maxilla from notch 2 feet 2 inches, breadth at base of beak 1 foot 3 ins. Elie, Firth of Forth, July 1879.
5. **Skull** of an adult about 30 feet long, with mandible. Length of skull in straight line 5 feet 9½ inches; length of maxilla from notch 3 feet 8 ins., breadth at base 2 feet. Nasals 6½ inches long, greatest breadth of each 2 ins. Figure below. Dunbar, September 1871.



6. **Skull**, young, 3 feet 4 inches long, with mandible and baleen wreaths *in situ*; length of maxilla from notch 2 feet 1 inch, breadth 1 foot 1 inch. Alloa, October 1888.
7. **Tympanic** bones, pair of, from skull No. 4. Length of bone 3½ inches, breadth 1·8 inch, vertical depth 2½ inches; outer surface convex, short and shallow, groove separating it into two divisions, anterior division 1½ inch long from groove, posterior division 1½ inch, anterior border ridged and defined by a shallow depression. Keel-like inferior ridge strong:

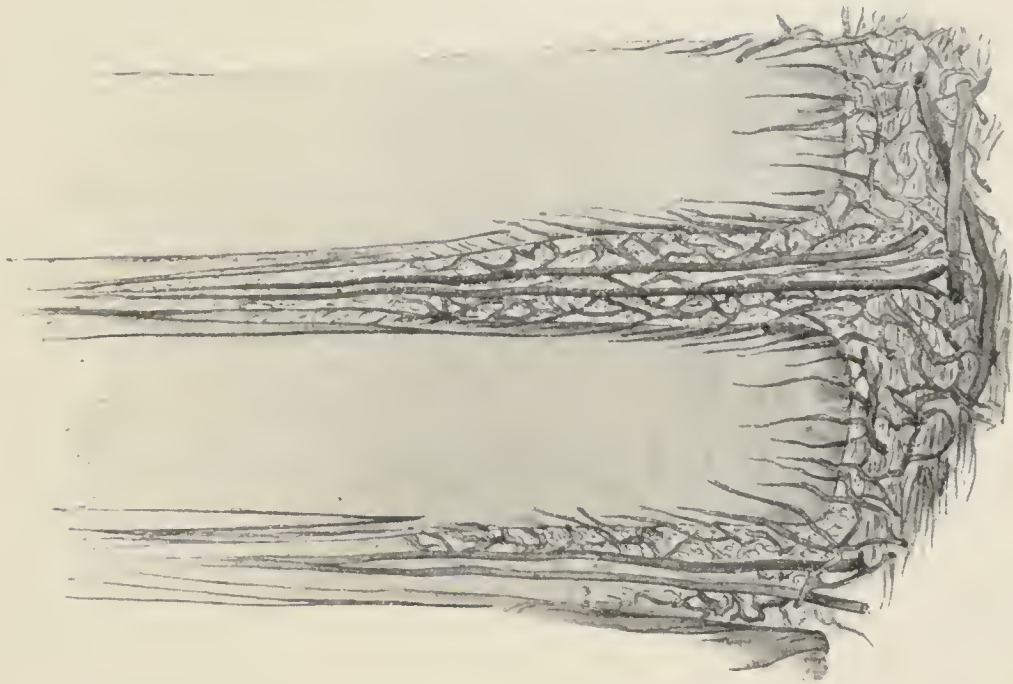
cavity opens horizontally at upper border of inner surface $1\frac{1}{2}$ inch above keel, Eustachian end well notched. Figure of outer surface below.

Elie, Fife, July 1879.



8. **Tympanic** bone, broken, right, with incus. Left bone on the skull, No. 6. Length $3\frac{1}{8}$ inches, breadth $1\frac{1}{2}$ inch, height $2\frac{1}{8}$ inches.
Alloa, 1888.
9. **Tympanic**, right; length $3\frac{1}{4}$ inches, breadth $1\frac{3}{4}$ inch, height $2\frac{1}{4}$ inches. Characters resemble No. 7.
10. **Baleen**, two specimens from *B. rostrata*, one with four plates, the other with eight plates, having the characters of the species. From the Dunbar example, No. 5.
11. **Baleen** wreath of *B. rostrata*, 38 inches in length: the plates and bristles have the characteristic yellow-white colour and the form and dimensions of the species. From a specimen caught at Stornoway.
Donor—John Methuen, Esq.
12. **Baleen**, end of wreath, from the *B. rostrata* stranded at Burntisland, September 1870 (No. 3). When fresh the plates were dull white with pink or rose tint.
13. **Baleen**. Longitudinal section through plates of the baleen of *B. rostrata*, No. 3. The palatal mucous membrane was injected red to show the blood-vessels in the folds and in the papillæ which extend into the plates of baleen. The pink tint seen in the white plates in

their fresh condition is due to the blood in the vascular papillæ. Described by Turner in *Trans. Roy. Soc. Edin.*, vol. xxvi., 1870. See figure below.



14. **Baleen.** Transverse section through plates of baleen and the intermediate substance in which they are imbedded; blood-vessels of the papillæ in the plates were injected red. From Burntisland specimen.
15. **Baleen.** Pharyngeal end of wreath of the specimen from Burntisland, *B. rostrata*. The baleen plates and the intermediate substance, or "gum" of the whaling seamen, have been stripped off the palatal mucous membrane to show the folds and papillæ, also the recesses in the wreath in which the folds and papillæ are lodged. Spirit preparation.
16. **Hyoid** bone of adult, body and cornua fused together; greatest breadth 1 foot 9 inches, concave on superior, convex on inferior surface, cornua swollen; stylohyoids flattened on surfaces, separate.
Dunbar, Firth of Forth, 1871.
17. **Vertebræ**, 1st and 2nd dorsal, left 1st rib, and sternum, articulated; sterno-vertebral diameter of thoracic inlet 16 inches. Sternum a Latin cross with long posterior limb: length of bone 20 inches, breadth $13\frac{1}{2}$ inches.
From No. 5.
Dunbar, 1871.
18. **Vertebræ**, atlas, axis, and five other cervicals; plates ossified to bodies; the bodies of axis and 3rd cervical fused; neural arch of 3rd imperfectly ossified, also

transverse processes from the 3rd to the end. From No. 5. Dunbar, 1871.

19. **Vertebræ**, five caudal, from the middle of the region, *B. rostrata*, No. 5. Dunbar, 1871.

20. **Sternum**, young, form of Latin cross, length $7\frac{1}{2}$ inches, right limb broken. From No. 4. Elie, Fife, 1879.

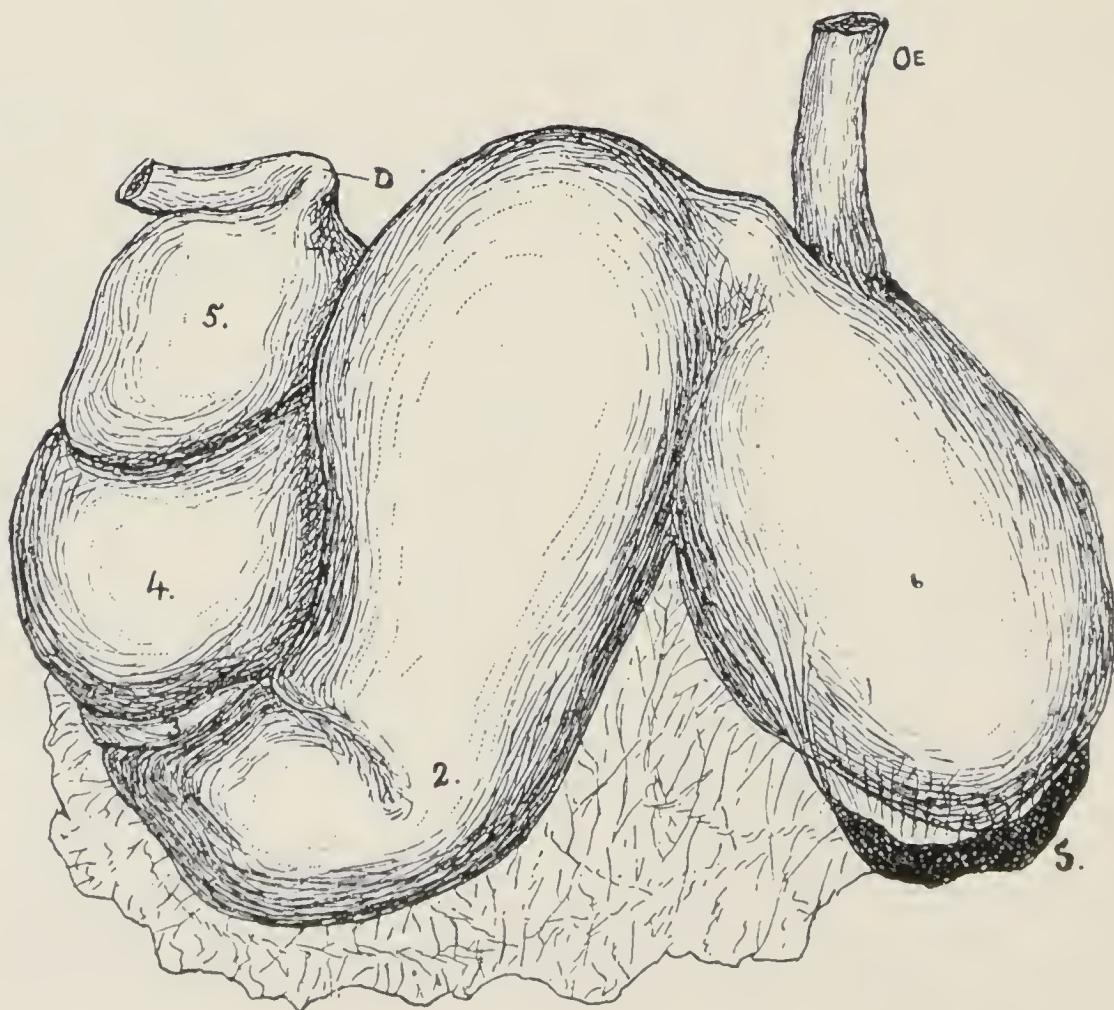
21. **Scapulæ**, right and left, adult, from No. 5. Dunbar, 1871.

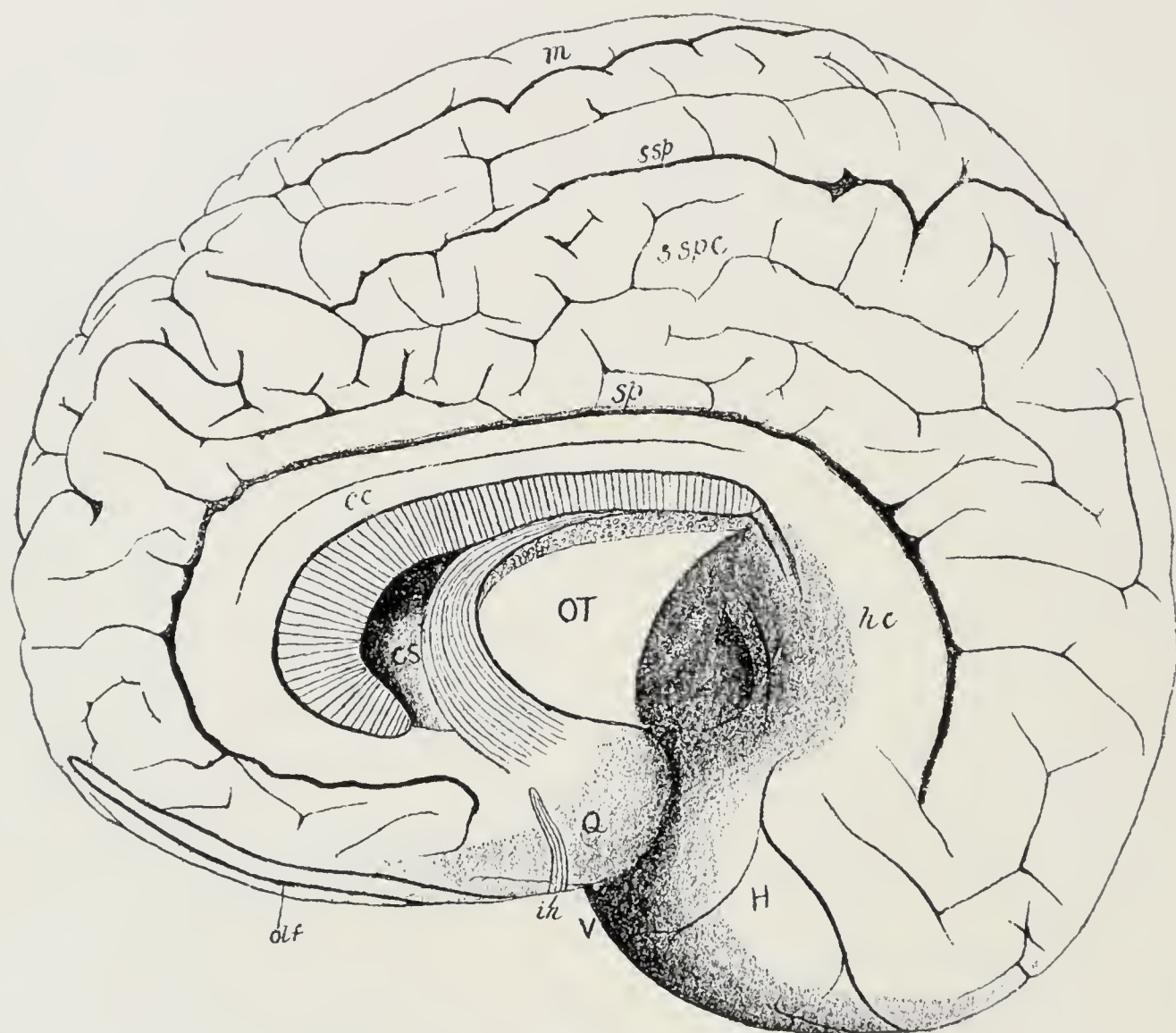
22. **Scapula**, right, young, from No. 4. Elie, Fife, 1879.

23. **Larynx** and trachea of *B. rostrata*, dried. It shows the pouch on the inferior surface inflated and opening into the interior of the larynx. The preparation was described by Knox in the *Catalogue* of his Museum.

Knox Collection, No. 36.

24. **Stomach** of *B. rostrata*, dried and inflated. It consists of a paunch-like compartment (1) into which the œsophagus, *Oe*, opens, of a large cardiac compartment, (2), of a small 3rd compartment, a much larger 4th, and a globe-shaped 5th compartment which opens into



*Balanoptera rostrata.*

OT, optic thalamus ; Q, quadrilateral space ; V, Sylvian fossa ; *olf* and *in*, olfactory peduncle and inner root ; H, lobus hippocampi ; *sp*, splenic, *ssp*, supra-splenic fissures ; *cc*, callosal, *hc*, hippocampal, *m*, marginal, *sspc*, supra-splenic convolutions.

the cylindriform duodenum, *D.* Spleen, *S.* Turner in *Proc. Roy. Soc. Edin.*, vol. xix., 1892. Figure, p. 64.

25. **Brain**, two hemispheres of cerebrum, of *B. rostrata*, without membranes. The mesial surface of the right hemisphere is described and figured in Sir Wm. Turner's memoir "On the Convolutions of the Brain," 1890. *Journ. Anat. and Phys.*, vol. xxv., 1891; also in Plate VIII. of *Catalogue*.
26. **Brain** of *B. rostrata*, partially dissected.

II. MEGAPTERA. (M.)

Megaptera, *Gray, Zool. Erebus and Terror*, p. 16, 1846.

Low, hump-like dorsal fin; skin of throat and chest plicated; tetradactylous. Scapula with coracoid rudimentary and acromion absent. Head moderate. Length 40 to 50 feet.

(1) MEGAPTERA BOOPS. (M. B.)

(Hump-back or Long-armed Whale.)

Balæna boops, *Linn., Syst. Nat.*, 1766.

Balæna longimana, *Rudolphi, Mem. Acad. Berlin*, 1829.

Megaptera boops, *Van Beneden and Gervais, Osteogr. Cet.*

Colour black; under surface of caudal and pectoral fins white. Pectoral fin narrow, very long, tuberculated on anterior border; dermal tubercles on head. Cervical vertebræ free or partially fused. Vertebral formula $C_7D_{14}L_{11}C_{21} = 53$.

1. **Baleen** plates, two, of a Megaptera towed into Wick Bay, March 1871. Colour black, bristles stiff; length of plate 25 inches, breadth at base 8 inches. Skeleton not preserved. The animal, a male, was 48 feet long and about the same in girth; the caudal fin was 15 feet from tip to tip; the pectoral limbs were said to be 14 feet long. The specimen was described by Mr W. Reid in *Land and Water*, 1st April 1871. See Alston's *Fauna of Scotland*, Glasgow, 1880.

Turner Collection.

2. **Baleen** plate, 21 inches long and $9\frac{1}{4}$ inches in greatest width. Colour black, bristles stiff. From a Megaptera

caught in the Mersey, near Spoke, in July 1863. The skeleton is in the Liverpool Museum.

Turner Collection.

3. **Vertebræ**, atlas, axis, 3rd and 4th cervical. Atlas distinct, transverse diameter 2 feet $2\frac{1}{2}$ inches; axis, 3rd and 4th, are partially fused together; transverse diameter of axis 2 feet 9 inches. The specimen was brought from New Zealand by the *Challenger* Expedition, and was described by Sir Wm. Turner in the *Reports*, vol. i., 1880, as *Megaptera lalandi* (Fischer). It is doubtful if it should be regarded as a distinct species. The atlas vertebra presents no appreciable difference from that in the specimens from the Cape of Good Hope.

[Nos. 4, 5, and 6 were obtained in a cargo of whales' bones collected at Saldanha Bay, and imported from the Cape of Good Hope into Leith in 1870 by Messrs J. & J. Cunningham, by whom they were presented.

Turner Collection.]

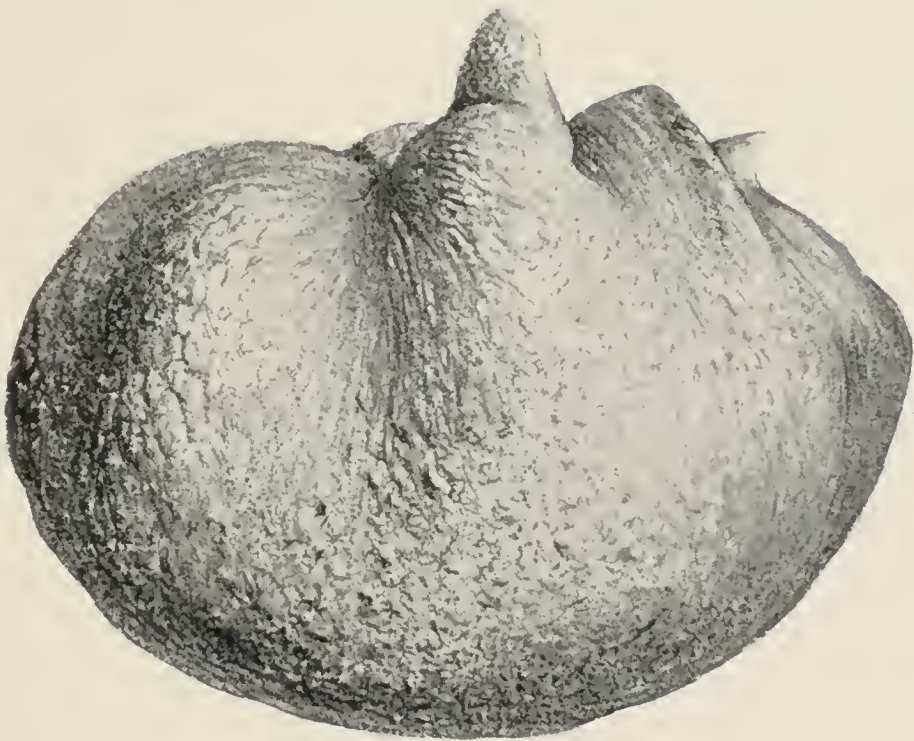
4. **Vertebræ**, atlas and axis, not fused. Atlas, transverse diameter 2 feet 5 inches; vertical, 1 foot $4\frac{1}{2}$ inches.
5. **Vertebra**, atlas, a massive bone. Transverse diameter 2 feet 11 inches; vertical, 1 foot 8 inches.
6. **Radius** and **ulna**, right. Radius 3 feet 3 inches long, ulna 2 feet 10 inches long; olecranon short.
7. **Mammary** pouch and two nipples of a male *M. boops*. The opening of the milk-duct is shown on each nipple. Between the nipples is a mesial projection which lies opposite the mouth of the pouch and can close it. From the Megaptera designated the Tay Whale, described by Sir John Struthers in *Journ. Anat. and Phys.*, 1887, vol. xxii.

Donor—Sir John Struthers.

[Tympanic, left, of the Tay Megaptera in the Public Museum, Dundee. Length 4·3 inches, breadth 2·6 inches, height the same. Outer surface separated by short, wide, moderately deep groove into two prominently convex divisions, of which the posterior is the larger. Anterior end blunt, rough, continued into rough inferior keel; posterior end a sharp ridge defined by a furrow. Inner surface less convex than outer, thick, rounded, and striated at the border of the cavity, which is 2 inches above the keel,

mostly horizontal, but depressed at Eustachian end. Keel not prominent, blends gently with adjoining inner and outer surfaces. See figures below.

The Periotic with large auditory foramina on the cerebral aspect, and on the tympanic surface a fenestra ovalis with stapes attached. Inferior surface smooth, convex, formed of dense bone, continuous with a mass of more cancellated bone for attachment to the skull.]



BALEEN WHALES.

Fossil and subfossil specimens.

1. **Tympanic** bone, marked *Balæna*, strongly mineralised.
From the Red Crag. Purchased.
2. **Tympanic** bones, two, of uncertain species, smooth, polished, and strongly mineralised.
From the Suffolk Crag, Felixstowe.
Donor—H. R. Pyatt, Esq.
3. **Tympanic** bone marked *Balæna emarginata*, strongly mineralised.
From the Red Crag. Purchased.
[Nos. 4 to 9 are from skeletons exposed in the clay subsoil in the raised beach of the Carse of Stirling, from the Collection formed by Sir Wm. Turner.]
4. **Skull** of a *Balenoptera* subfossil, much injured; approximate length 9 feet 2 inches, greatest breadth 4 feet 6 inches; outer edge of maxilla almost straight; greatest breadth of back of skull 4 feet 4 inches, foramen magnum $4\frac{1}{2}$ inches by 5; length of vomer 8 feet 3 inches. Portion of the skeleton found in Christie's Brickfield, Cow Park, Stirling, in blue clay, in 1863 (see Introduction). The skull approaches in size and proportions that of *B. musculus*, No. 1, in the Museum, and may be regarded as that species.
Donor—Corporation of Stirling.
5. **Mandible** of the same specimen, not united at symphysis, coronoid distinct; length along convex surface 9 feet $6\frac{1}{2}$ inches; length of chord of arc 9 feet $1\frac{1}{4}$ inch; girth in front of coronoid process $25\frac{1}{2}$ inches.
Donor—Corporation of Stirling.
6. **Rib**, 1st left, from the same skeleton, No. 4; length 3 feet 5 inches on the curve, 2 feet on the chord of the arc. The vertebral end has two distinct heads separated by a cleft $6\frac{1}{4}$ inches deep, which is prolonged as a groove on to the body of the rib; the anterior head has a definite articular surface, which is less strongly marked on the posterior head. The bicipital end of the 1st rib is a character which has been seen in several specimens of *B. borealis*, though not present in the skeleton of this whale in the Anatomical Museum. See figure, p. 69.

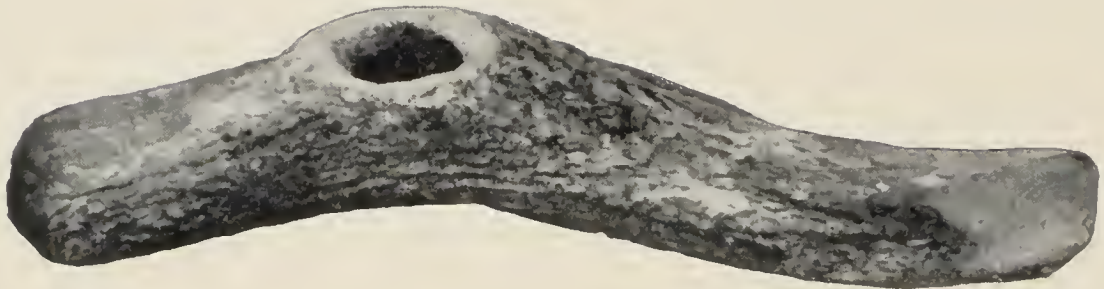


7. **Tympanic** bones, pair of; length $4\frac{3}{4}$ inches, breadth $2\frac{3}{4}$ inches. The surfaces are more convex than in *B. borealis*, the anterior border is more strongly defined by a groove, and the posterior half of the inferior keel is broader. In these characters the bone corresponds with *B. musculus*. From the skeleton of a whale exposed in draining a field at Woodyett, Meiklewood, Gargunnock, Carse of Stirling, in 1877. See Introduction, p. 9, and figure below.



8. **Vertebræ**, two, from the skeleton of the Meiklewood whale; processes broken. The body of the cervical is 11 inches in transverse by 7 inches in supero-inferior diameter, that of the lumbar 11 by 8 inches. The vertebral plates not fused with the bodies.

9. **Implement** made out of the beam of the antler of the Red Deer (*Cervus elephas*) found beside the skull of the Meiklewood whale, No. 6; it lay vertically in the blue silt. It is 11 inches long by $6\frac{1}{2}$ inches in greatest girth. A hole had been bored 4 inches from one end of the implement and 7 inches from the other, and the hole was occupied by a piece of wood $1\frac{3}{4}$ inch long, obviously the remains of a handle; the short end was truncated or hammer-shaped, the long end was bevelled or chisel-shaped. Described by Sir Wm. Turner in *Reports of Brit. Assoc.*, 1889, p. 790; in "Early Man in Scotland," *Proc. Royal Institution*, March 1897; and figured by Dr R. Munro in *Prehistoric Scotland*, 1899. See Introduction, p. 9.



Suborder 2. ODONTOCETI. (O.C.)

(Toothed Whales. No Baleen.)

Family I. PHYSETERIDÆ.

Maxillæ raised into large crests; symphysis of mandible long and laterally compressed; functional teeth in lower but not in upper jaw; throat with two or more furrows; costal cartilages not ossified; pentadactylous.

Subfamily PHYSETERINÆ.

Numerous teeth in mandible set in a long groove; narial region very asymmetrical. Lachrymals distinct. Pterygoids meeting mesially.

I. PHYSETER. (Ph.)

Physeter, *Linnaeus, Syst. Nat.*, 1766.

(1) PHYSETER MACROCEPHALUS. (Ph. M.)

(Sperm Whale or Cachalot.)

Physeter macrocephalus, *Linnaeus, supra cit.*



Head massive, truncated, blowhole single at upper part of front of head, pair of high maxillary crests separated by a deep hollow for lodgment of spermaceti; rostrum and mandible long, tapering to a point, the latter with twenty to twenty-five functional

teeth on each side; right premaxilla much larger than left; right naris smaller and not in same transverse plane as left. Vomer distinct in middle of hard palate. Colour black on dorsum, venter grey. Length of male 50–60 feet; dorsal fin a low hump, pectoral fin short; vertebral formula $C_7D_{11}L_8Cd_{24}=50$.

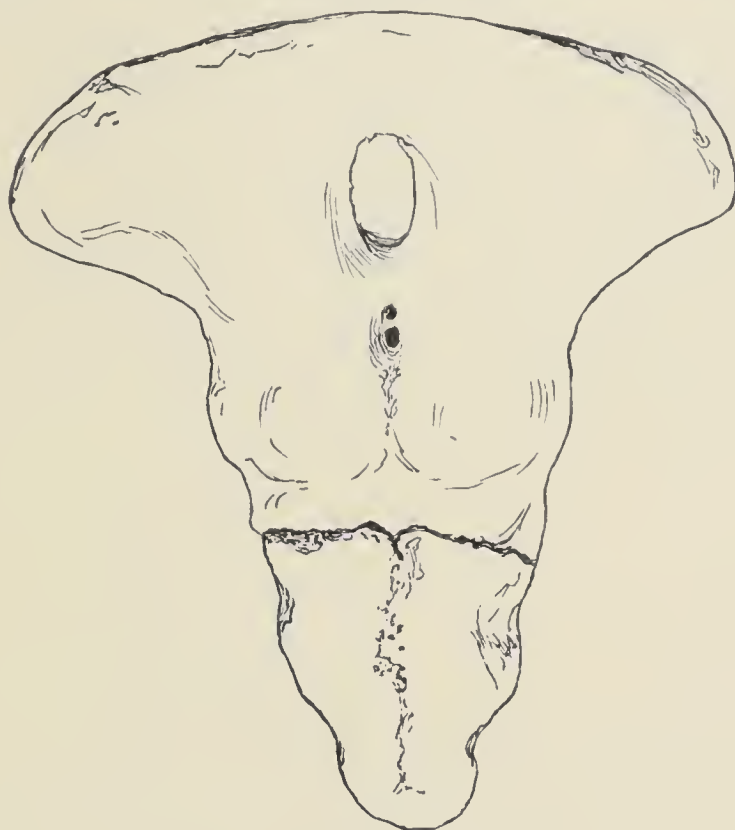
1. **Mandible** of adult male, probably about 60 feet long. Length of mandible 15 feet 10 inches; length of symphysis 9 feet 8 inches. Teeth removed. Stranded in Loch Scavaig, Isle of Skye, July 1871. Described by Sir Wm. Turner in *Proc. Roy. Soc. Edin.*, vol. vii. p. 632, 1872.

[Nos. 1 to 8 are from the Sperm Whale stranded in Loch Scavaig, 1871. Turner Collection.]

2. **Tooth**, mandibular, extracted from jaw, also vertical section through another tooth of the same Cachalot.
Donor—Mr J. Mackinnon.
3. **Teeth**. Series of aborted maxillary teeth of the same Cachalot.
Donor—Mr J. Mackinnon.
4. **Ribs**, three. Right first, width of sternal end 18 inches, 6 feet $2\frac{1}{2}$ inches on convex border, chord of arc 3 feet 2 inches. Pair of the longest ribs, each 9 feet 5 inches along curve of arc; chord of the arc 5 feet 6 inches.
5. **Sternum** of the same whale, fully ossified—a massive bone, triangular in form, 50 inches long, 40 inches wide at



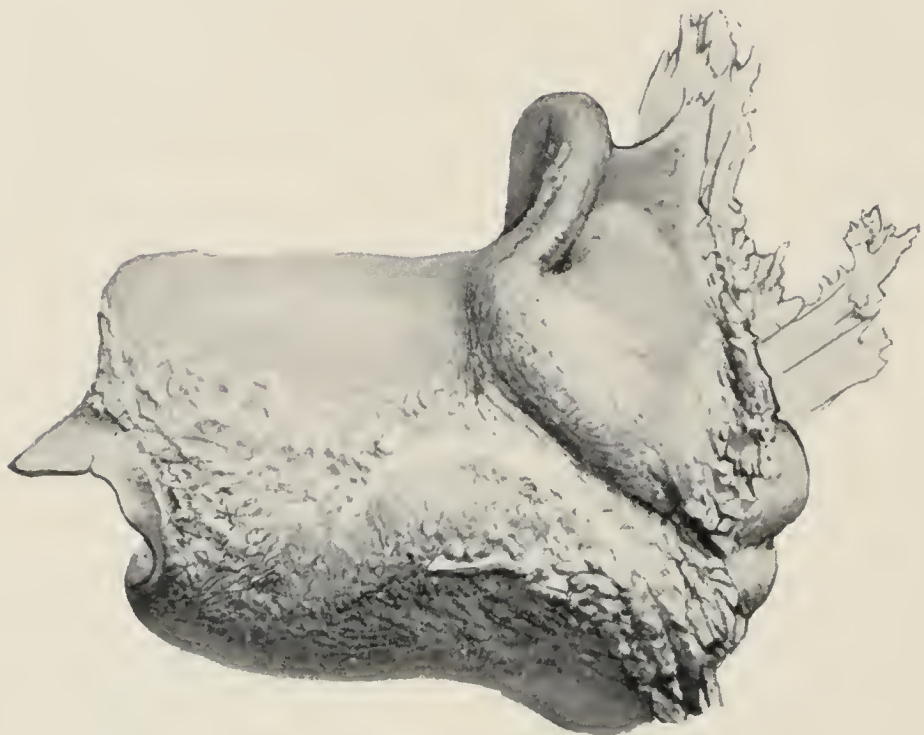
manubrium, four pairs of costal facets; two mesial foramina; a transverse fissure on the upper surface marks the plane of separation between the second and third segments. Turner in *Journ. Anat. and Phys.*, 1872, vol. vi. Figures, pp. 72, 73.

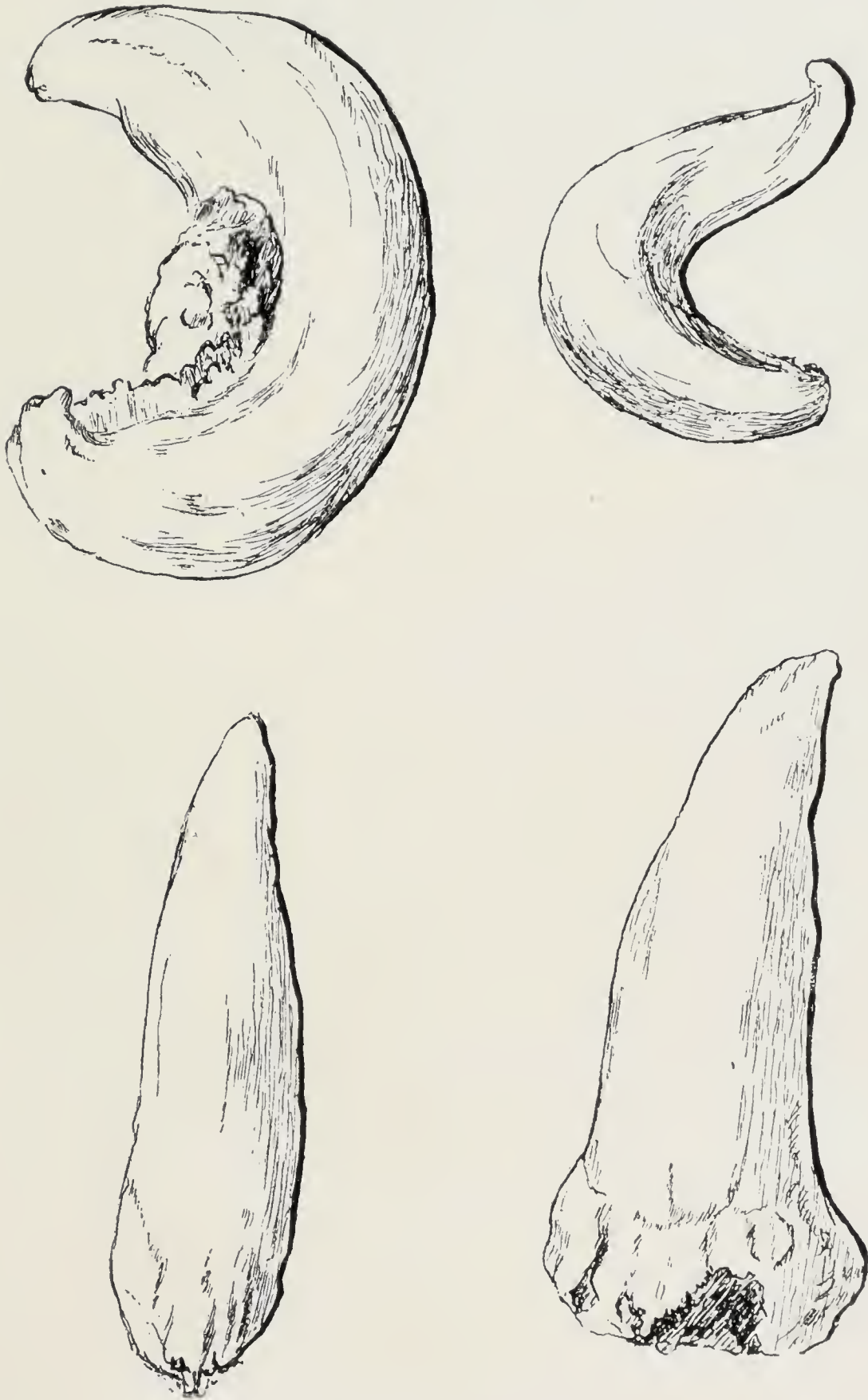


6. **Vertebræ**, two lumbar, plates ossified to bodies; also four chevron bones, the longest of which measured 2 feet.
7. **Radius** and **ulna**, fused together at each end. Length of radius 16 inches, greatest breadth 9 inches; ulna, length of, 13 inches, carpal breadth 9 inches; olecranon strong.
8. **Metacarpal** bone, proximal epiphysis ossified, but not fused with shaft. Donor—Mr J. Mackinnon.
[Nos. 9 to 12 were obtained from Thos. Anderson, Esq., Hillswick, Shetland.]
9. **Mandible** of an adult male Sperm Whale, said to be about 61 feet long, towed into Roeness Voe, Shetland, in August 1901. The mandible is 16 feet 3 inches long, and the length of the symphysis is 10 feet 3 inches; the teeth are present, $\overline{23} \overline{23}$. Described by Turner in *Proc. Roy. Soc. Edin.*, 1903, vol. xxiv.
10. **Harpoon**, head of a pointed explosive massive iron, found in the head of the same whale. It had penetrated

the great cavity in the skull in which the spermaceti had been contained.

11. **Teeth**, maxillary, fifteen in number. They vary in length from 69 to 80 mm.; some curved, others pointed at both ends; some have a pulp cavity, others none, others roughened by odontomatous growths. They are obviously rudimentary and functionless. From the Shetland Cachalot, No. 9. Plate IX.
12. **Tympano-periotic** bones, pair of, from No. 9; the bones on each side are not fused together. The Tympanic bone is $2\frac{1}{2}$ inches long, 1.6 inch broad, $1\frac{3}{4}$ inch high; the inferior surface bilobed posteriorly, lobes separated by oblique groove, outer lobe the larger; outer surface convex and smooth, giving origin to lip-like process which reaches mouth of cavity; inner





Sperm Whale. Maxillary teeth.

surface continued thick round border of mouth, and divided by deep depression into anterior and posterior convexities, almost equal; arched Eustachian end of cavity opens close to the inferior surface. Petrosal, $2\frac{1}{2}$ inches by $1\frac{1}{2}$ inch broad, articulates with tympanic by a broad process, surface of which is striated and concavo-convex. Described by Turner, *Proc. Roy. Soc. Edin.*, 1903. Figures, p. 74.

13. **Mandible** of a young Cachalot, not fused at the symphysis; length 6 feet 9 inches, length of symphysis 3 feet 4 inches. Caught in the lat. of Azores, North Atlantic Ocean. Donor—Dr F. B. Archer, Barbados.
14. **Teeth**, forty-four in number, from the mandible of No. 13. The pulp cavity is proportionally large.
Barbados, 1871. Donor—Dr F. B. Archer.
15. **Teeth**, three mandibular.
N. Harris, 1905. Donor—Dr Duncan Fletcher, through Professor Chiene.
16. **Tooth** from a Sperm Whale captured at Dunstaffnage Bay, Oban, in May 1829. See Turner in *Proc. Roy. Soc. Edin.*, vol. vii. p 365, 1872.
Donor—Dr John Alex. Smith.
17. **Teeth**, two mandibular; the longer is $8\frac{1}{2}$ inches, the shorter is 7 inches.
Purchased from Woodcock Collection, Anstruther, October 15, 1887. Turner Collection.
18. **Teeth**, two mandibular, brought from St Helena, November 1900. Donor—Professor Chiene.
19. **Tooth**, mandibular, 8 inches long, from an adult Sperm Whale.
20. **Teeth**, two mandibular, from a relatively young Cachalot. In one the crown is only slightly worn and the pulp cavity is smooth. In the other, one side of the fang is cleft and the pulp cavity is lined by irregular nodules, due to morbid changes.

II. KOGIA. (K.)

(Pigmy Sperm Whale.)

Kogia, Gray, *Zool. Erebus and Terror*, 1846.

Euphysetes, Wall, *New Sperm Whale*, Sydney, 1851.

Head small, snout short, blowhole on forehead, dorsal fin falcate. Length of animal 9 to 13 feet. Ap-

parently more than one species, Indian Ocean, Pacific, Australasian Seas.

No specimen in Museum.

[Tympanic, drawing of *Kogia*, from bone in Museum of Zoology, University, Cambridge. Tympanic, length $1\frac{2}{10}$ inch, breadth $\frac{3}{4}$ inch; two-lobed, outer the longer, separated by a shallow groove; inferior surface smooth; anterior end opened by a sharp-arched border immediately above the inferior surface; posteriorly the tympanic was united by a constricted neck to an irregular piece of bone, formed of light cancellated tissue, which probably represented a "mastoid." Periotic $1\frac{1}{10}$ inch long, $\frac{3}{4}$ inch broad; internal meatus with a cribriform wall for transmission of auditory nerve; tympanic aspect with fenestra ovalis and f. rotunda.]



Subfamily ZIPHIINÆ.

(Beaked Whales.)

Beak in the head bounded behind by rounded eminence in front of nares. Blowhole single, mesial, crescentic. One or rarely two pairs of functional mandibular teeth. Numerous undeveloped teeth in gums. Caudal fin convex in middle of posterior border.

III. ZIPHIUS. (Z.)

Ziphius, Cuvier, *Ossements fossiles*, 1823.

Colour purple-black on back, white on ventral surface; one developed tooth on each side of symphysis of mandible; premaxillæ expanded and raised as asymmetrical eminences, bounding bowl-shaped prenasal cavity; medio-rostral bone strong; conjoined nasals concave forwards, forming summit of cranium; dorsal fin; vertebral formula C_7D_9 or $_{10}L_{11}Cd_{21} = 49$. Length not exceeding 26 feet.

(1) ZIPHIUS CAVIROSTRIS, Cuvier. (Z. c.)

(Cuvier's Ziphius.)

Epiodon chathamensis, Hector, *Trans. New Zealand Inst.*, 1873.

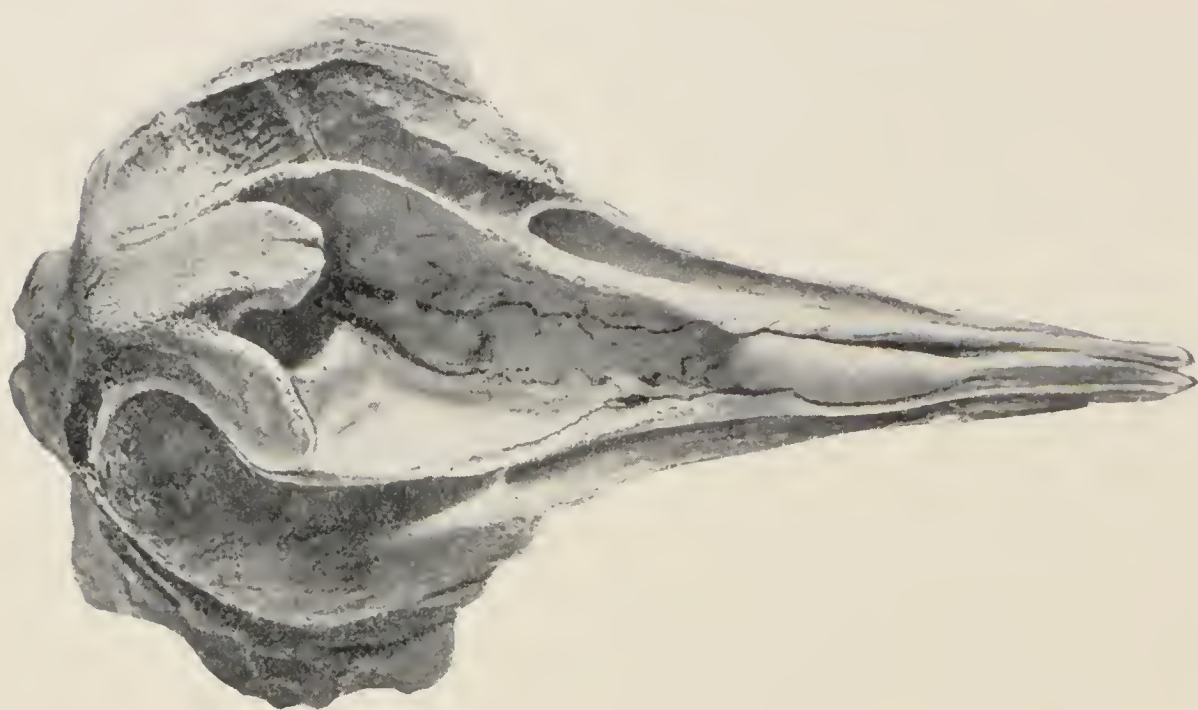
Medio-rostral bone swollen in middle to a thick, dense bar, attenuated at its anterior end.

1. **Skull**, adult, with mandible. Length $36\frac{1}{2}$ inches, breadth 20 inches, height 18 inches. Medio-rostral bone, length 13 inches, $2\frac{1}{8}$ inches in greatest width, attenuated anteriorly; length of beak $21\frac{1}{4}$ inches, breadth at base 12 inches; length of ankylosed symphysis 7 inches. The naso-premaxillary and rostral regions very characteristic. Mandible $32\frac{1}{2}$ inches long, teeth absent, sockets occupied by coarse bone. The whale was caught in 1870 off Hamna Voe, Shetland, and the skull was described by Turner



in *Trans. Roy. Soc. Edin.*, vol. xxvi., 1872. The first example of the species to be recognised as British. Profile figured, p. 77; dorsum, p. 78.

From John Anderson, Esq., Hillswick, Shetland.



2. **Tympano-periotic** bones, right, not fused. Stapes *in situ*. From No. 1. Tympanic $2\frac{3}{8}$ inches long, $1\frac{7}{8}$ inch broad. Outer surface divided into small posterior and large anterior parts by narrow, sharp fissure in front of lip-like process, which is continued for a short distance on this surface. Inner surface striated, divided by a fissure into a deeper posterior and a shallow, thinner anterior part. The inferior surface is not definitely bilobed, $1\frac{1}{2}$ inch high, but is marked by a longitudinal ridge which ends behind



in a smooth projection representing the outer lobe in *Mesoplodon*; a minute tubercle separated from the projection by a faint groove may represent the inner lobe; the cavity opens by a wide Eustachian orifice close to the anterior end of the inferior surface. Periotic $2\frac{4}{10}$ inches long, $1\frac{4}{10}$ inch broad. The stapes is attached to wall of tympanic cavity. Figured in *Trans. Roy Soc. Edin.*, vol. xxvi., 1872, also on p. 78 and below. Turner Collection.



3. **Skull**, adult, with mandible, presented by Sir James Hector and labelled *Epiodon chathamensis*; occipital, pterygoid, and palatal regions imperfect; length of beak 21 inches, breadth at base $10\frac{1}{2}$ inches; medio-rostral bone, length $15\frac{1}{4}$ inches, breadth $2\frac{1}{8}$ inches, attenuated anteriorly. Mandible, length 2 feet $9\frac{1}{2}$ inches, teeth absent, sockets filled with bone, length of symphysis 8 inches. See Turner, *Challenger Reports*, part iv., 1880, for description. When compared with the Shetland *Ziphius*, No. 1, no specific difference appeared to exist between them. Chatham Islands. Challenger Collection.

(2) ZIPHIUS MEDILINEATUS, Owen. (Z. M.)

1. **Rostrum**, cast of mineralised beak, from the Suffolk Red Crag. Purchased from Mr Edward Charlesworth.

(3) ZIPHIUS, SPECIES UNCERTAIN.

1. **Rostrum**, two vertical transverse sections of the mineralised beak of a fossil *Ziphius*.
From the Suffolk Red Crag, Woodbridge.
Purchased from Mr Edward Charlesworth.

IV. HYPEROODON. (H.)

Hyperoodon, *Lacépède, Hist. Nat. des Cétacées*, 1804.

Skull with massive maxillary crests in adult male, relatively slender in female and in young male; premaxillæ elevated behind nares and expanded asymmetrically so that anterior surface overhangs nares. Nasal bones between premaxillæ concave forward; mesethmoid imperfectly ossified; a single tooth near tip of each half of mandible, many undeveloped teeth in gum; sternum composed of three segments; cervical vertebræ mostly fused together; caudal fin with posterior border concavo-convex; blowhole transverse, crescentic.

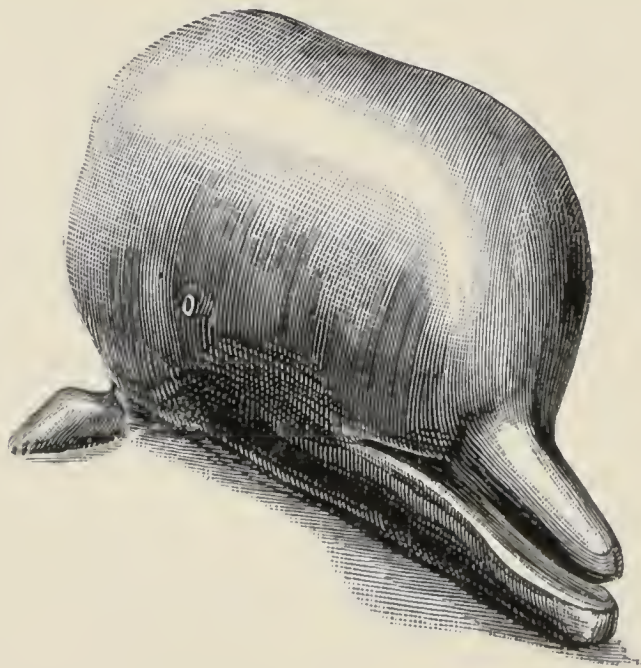
(1) HYPEROODON ROSTRATUS. (H. R.)

(Bottlenose Whale.)

Balæna rostrata, *O. H. Müller, Zool. Dan. Prod.*, 1776.

Hyperoodon butskopf, *Lacépède, supra cit.*

Hyperoodon bidens, *Fleming, British Animals*, 1828.

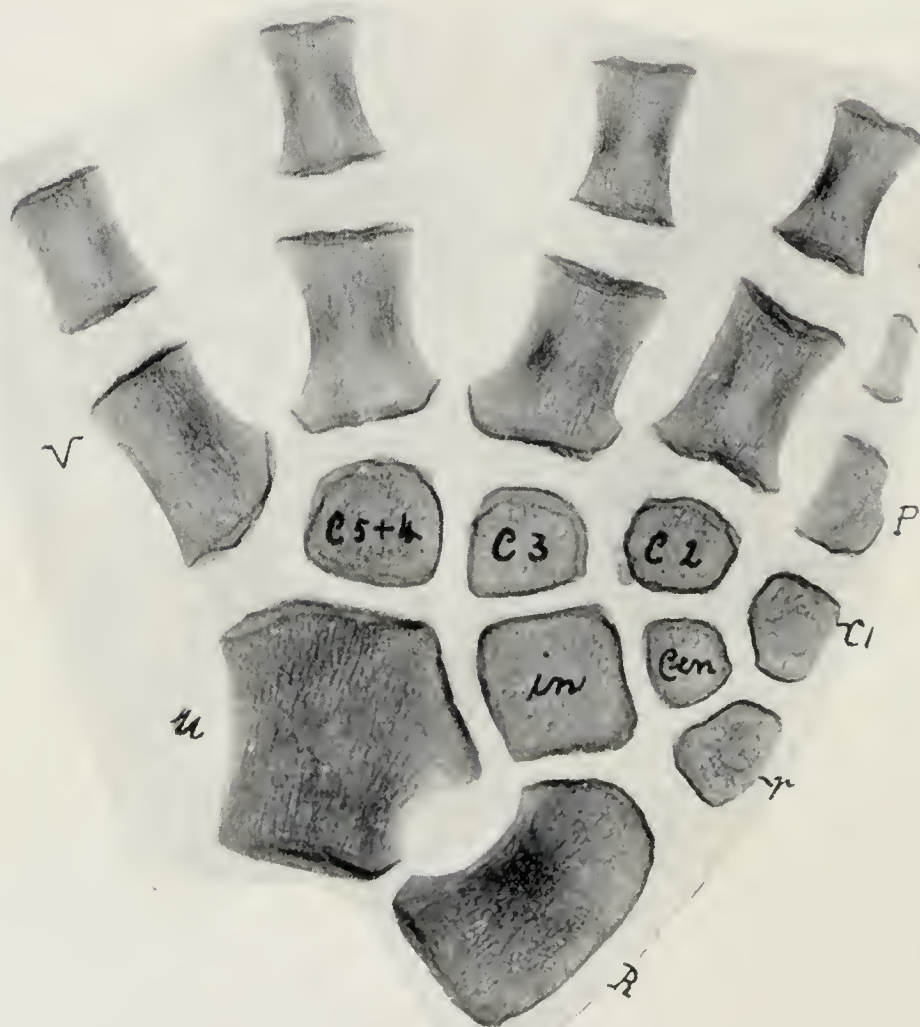


Colour black or greyish black on back and sides, yellowish grey on ventral surface; pair of lateral furrows on under part of throat; head with boss-like frontal protuberance, below which an attenuated beak constitutes "the neck of the bottle"; dorsal fin high behind the middle of the back; pectoral fin relatively small; length from 20 to 30 feet.



Hyperoodon. Manus.

r, i, u, proximal carpals; *p*, pisiform; *c*₁ to *c*₅, distal carpals;
I to V, metacarpals; P, pollex.



Platanista gangetica. Manus.

1. **Skeleton**, young male, articulated, maxillary crests relatively slender. Referred to by Wm. Thompson in *Ann. Natural Hist.*, vol. xvii., 1846. See Plate V. Manus figured in Plate X.

Alloa, October 1845.

Goodsir Collection.

[No. 2 to No. 19 are from the Turner Collection.]

2. **Skeleton**, young female, articulated, with dorsal fin *in situ*, pelvic bones present, maxillary crests relatively slender. Vertebral formula $C_7D_9LCd_{29}=45$. The animal is described by Turner in *Proc. Roy. Physical Soc.*, Edinburgh, vol. ix., 1886. See Plate I.

Dunbar, November 1885.

3. **Skull**, aged male, with broad, high, massive maxillary crests; beak and mandible wanting. See Turner, *Proc. Roy. Physical Soc.*, Edinburgh, 1889, vol. x.

Hole of Scraada, Shetland, March 1883.

Donor—John Anderson, Esq.

4. **Skull**, aged male, with broad, high, massive maxillary crests, also mandible. Length of skull 6 feet 2 inches, breadth 3 feet 5 inches; length of beak 3 feet 9 inches, breadth 1 foot $6\frac{1}{4}$ inches; crests much higher than the vertex cranii, breadth $8\frac{1}{2}$ inches, length 3 feet, narrowest diameter of intermediate cleft $\frac{3}{4}$ inch; pterygoids large, 21 inches long, conjoined breadth $8\frac{3}{4}$ inches, articulating mesially; length of mandible 5 feet; length of symphysis 20 inches. See figure below. J. E. Gray, in *Zoology of Voyage, Erebus and Terror*, 1846, regarded skulls with massive crests as a distinct species, *Hyperoodon latifrons*.

North Atlantic, 1889.

Donor—Dr Robert Gray, Peterhead.



5. **Skull**, with right half of mandible; maxillary crests moderate, interval 7 inches broad; length of skull 4 feet 9½ inches, breadth 2 feet 6½ inches; length of beak 3 feet, breadth 1 foot 2½ inches; length of mandible 3 feet 11¼ inches; length of symphysis 15 inches; an unprotruded tooth at tip of right mandible. Referred to in *Proc. Roy. Physical Soc.*, vol. ix., 1886. Hanna Voe, Shetland, August 1871.

Donor—J. Anderson, Esq.

6. **Skull**, young male, with relatively slender maxillary crests; beak broken at free end; length of crest 13½ inches, breadth 2½ inches; breadth of interval 6½ inches. Referred to in same *Proceedings*, vol. ix., in which the measurements of four of these skulls are given.

Loch Ranza, Arran, October 1883.

Donor—Dr Neil Fullarton.

7. **Teeth**, pair of well-grown mandibular.

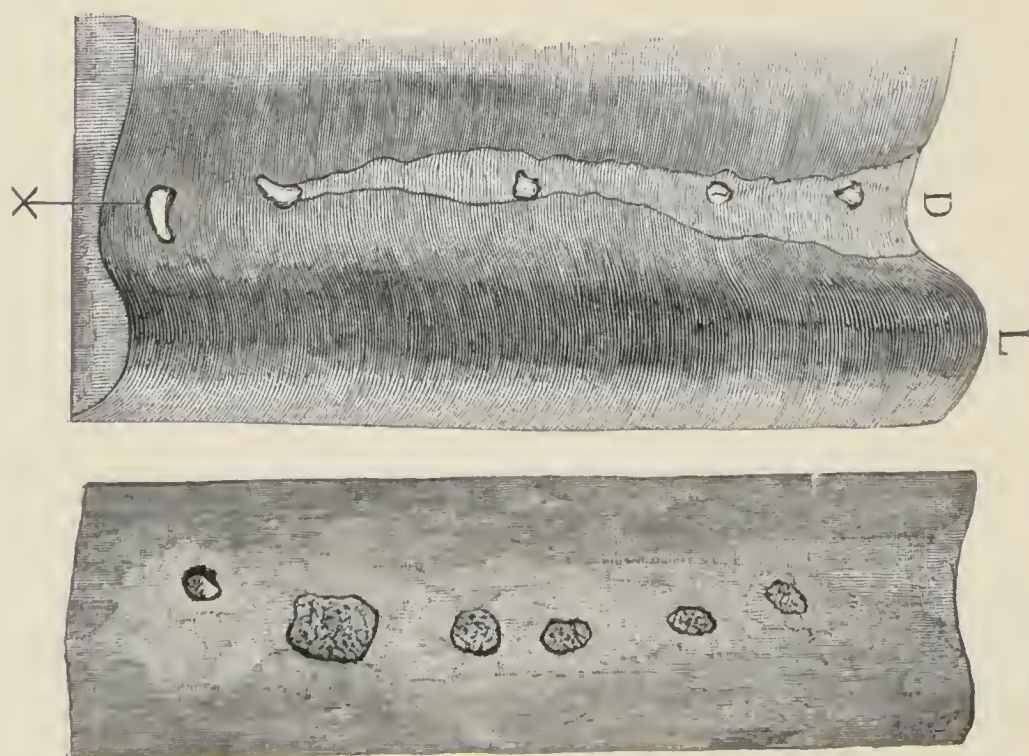
Hillswick, Shetland.

Donor—Dr John Anderson.

[The specimens Nos. 8 to 11, preserved in spirit, from the Dunbar Hyperoodon, No. 2. See Turner, *Proc. Roy. Physical Soc.*, vol. ix., 1886.]

8. **Teeth**, rudimentary, with pulps in dental groove in gum of upper jaw; two calcified teeth protrude through the gum, also rudiments in tooth sac. D, dental groove; L, lip.

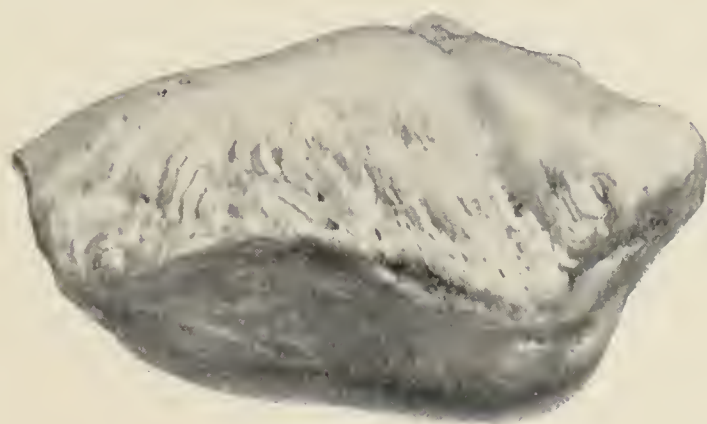
9. **Teeth**, rudimentary, with dental pulps and gum from mandible, very immature.



10. **Teeth**, rudimentary, projecting through gum from mandible, calcified and with acute points.
11. **Hard palate**, mucous membrane of, rough, with numerous short, blunt papillæ.
12. **Tympano-periotic bones**, pair of. Length of Tympanic $2\frac{1}{4}$ inches, greatest breadth $1\frac{1}{4}$ inch, height $1\frac{1}{4}$ inch. Outer surface convex, divided by an oblique groove into two bulgings; from the groove to the anterior border is $1\frac{1}{2}$ inch, to the posterior border 1 inch; the lip-like process ascends for $\frac{7}{8}$ inch from the upper border of the posterior bulging, and is prolonged down the outer surface. The inner surface is striated, and divided into a thick posterior part $\frac{7}{8}$ inch high, and an anterior longer part only $\frac{1}{2}$ inch high. The inferior aspect is $1\frac{1}{4}$ inch broad, and may be called a surface; posteriorly it presents a distinct outer lobe, but the inner is a rudimentary tubercle; a shallow groove separates them, in which is a narrow ridge, which extends to the anterior end of this surface; the cavity has a wide opening close to the Eustachian end of the inferior surface. Corresponding characters exist in the tympanics of the other crania of Hyperoodon. See figure of inferior surface below. Periotic, length $2\frac{1}{2}$ inches, breadth $1\frac{1}{2}$ inch.

September 1888.

Donor—Capt. Phillips, "Nova Zembla," Dundee.



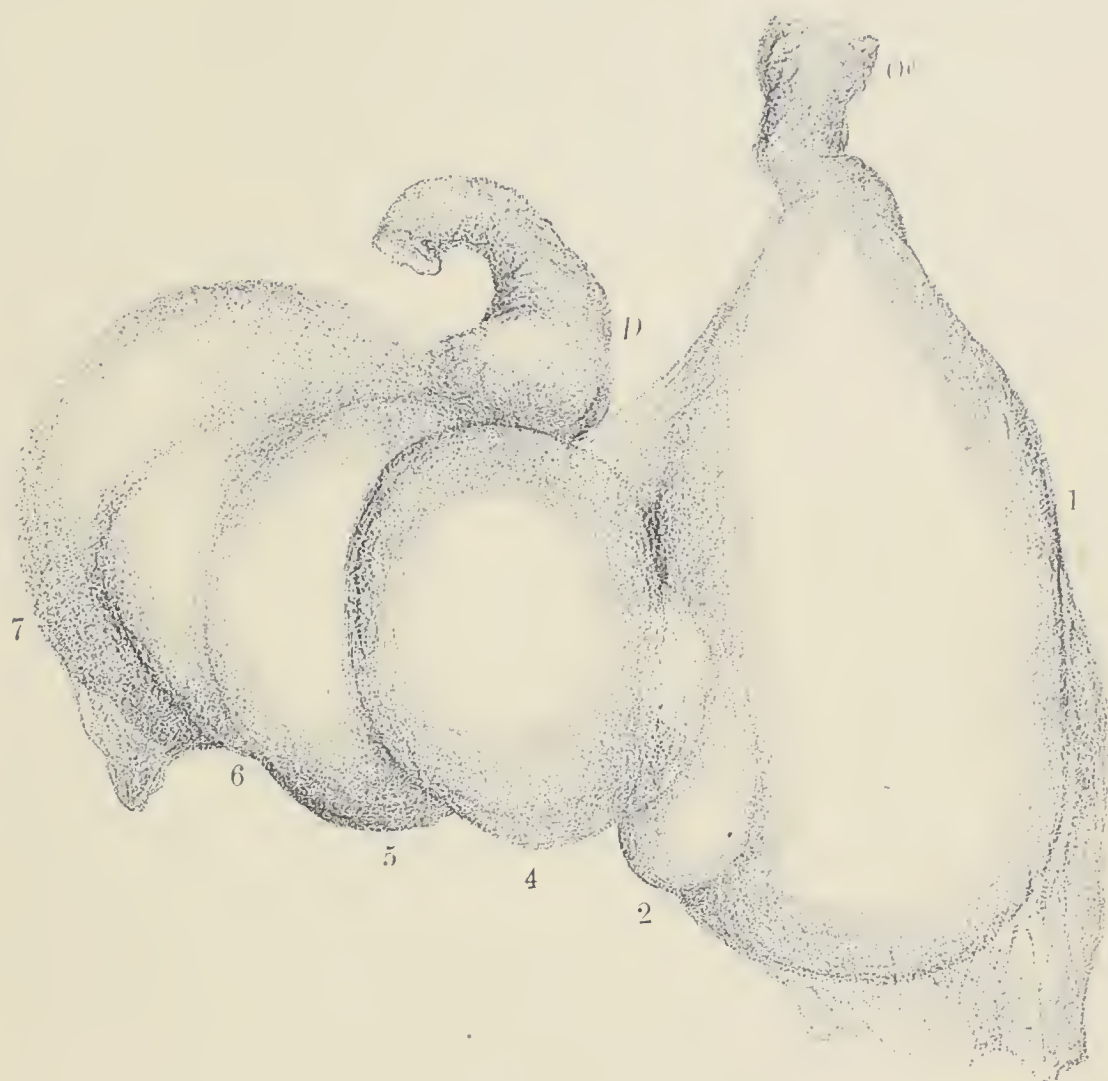
13. **Tympano-periotic bones**, imperfect.
Shetland, 1872.
14. **Tympano-periotic bones** from No. 2. Tympanic, length $2\frac{1}{4}$ inches, breadth $1\frac{1}{2}$ inch, height $1\frac{1}{8}$ inch. Periotic, length $2\frac{1}{2}$ inches.
Dunbar, 1885.

15. **Tympano-periotic** bone, left. Length of tympanic $2\frac{1}{4}$ inches, breadth $1\frac{3}{8}$ inch, height $1\frac{1}{2}$ inch. Periotic, length $2\frac{5}{8}$ inches.
16. **Periotic** bone, right (old male). Donor—Dr R. Gray.
17. **Hyoid** bone from No. 6. The body and cornua have not fused, the stylo-hyoids are distinct.
Loch Ranza, Arran. Donor—Dr N. Fullarton.
18. **Vertebræ**, cervical and upper eight dorsal, from No. 5.
Hamna Voe, Shetland, 1871.
19. **Vertebræ**, nine lumbar, from No. 5.
Hamna Voe, Shetland, 1871.

[No. 20 to No. 22 are from the Collection formed by Professor Goodsir.]

20. **Radius**, longitudinal section of. One end of the radius of No. 1, showing the cartilaginous epiphysis and the Haversian canals in its substance.
21. **Tongue** of Hyperoodon, showing the papillæ on the dorsum, especially at the base, and the fringes of mucous membrane on the borders and at the tip.
22. **Œsophagus**, transverse section through, inverted, showing longitudinal folds of the mucous lining.
23. **Stomach** of the Hyperoodon, No. 1, inflated and dried. It consisted of a large cardiac or proximal division into which the œsophagus opened, an intermediate division consisting of five subglobular compartments varying in size, and a large distal or pyloric division, which opened into the funnel-shaped dilated duodenum. See Turner in *Journ. Anat. and Phys.*, vol. xx. p. 470, 1885.

[To illustrate the appearance of the ventral surface of the stomach in Hyperoodon, a figure from the description by Sir Wm. Turner of the Dunbar specimen, No. 2, in the *Journ. Anat. and Phys.*, vol. xxiii., 1889, is reproduced. The numerals 1 to 7 indicate the gastric compartments. D, duodenum : Œ, œsophagus. See page 85.]



24. **Stomach.** Beaks of cuttle-fish, being contents of the stomach and duodenum of the Hyperoodon taken at Dunbar in 1885, No. 2. Turner Collection.

25. **Intestine,** small, of the Bottle-nosed Whale, inverted, showing valvulæ conniventes, the blood-vessels of which have been injected. Goodsir Collection.

[The brains No. 26 to No. 30 were removed from the cranial cavity by Dr Robert Gray, Peterhead, and were presented by Sir John Batty Tuke, M.P.]

26. **Brain** of Hyperoodon without the membranes. Weight 6 lb. 6 oz.

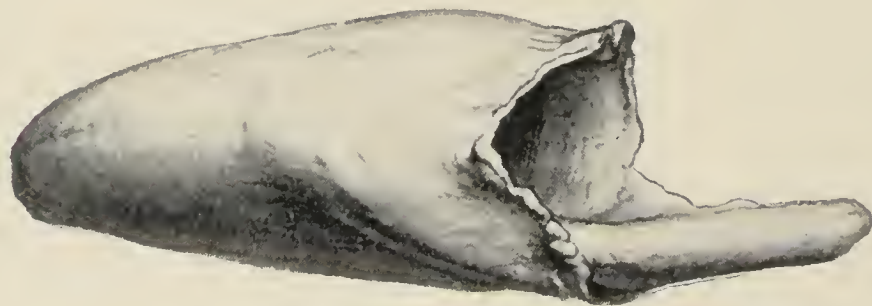
27. **Brain** of Hyperoodon. Weight when fresh 6 lb. 7 oz.; the membranes have been taken off.

28. **Brain** of Hyperoodon with its membranes. Weight 7 lb.

29. **Brain** of Hyperoodon without membranes. Weight 6 lb.

30. **Brain** of Hyperoodon cut into a number of sections. Weight 6 lb. 2 oz.

31. **Eyeball**, in the orbit, antero-posterior section with the eyelids, the palpebral fissure, and the two grooves in the lids; the retractor muscle, two of the recti, and the orbicularis are seen in the section, as well as the lens, the vitreous body, the coats of the eyeball, and the optic nerve. Goodsir Collection.
32. **Eyelids** with palpebral fissures. In each lid is a groove parallel to the fissure, which apparently facilitates the movement of the lids. The opposite surface of the preparation shows in section the anterior segment of the eyeball. Goodsir Collection.
33. **Ear**. Integument of Hyperoodon from the auditory region, showing the minute orifice of the external auditory meatus on the surface. Turner Collection.
34. **Tympanum**. Fibro-mucous membrane, pouch-like lining of the tympanic cavity of Hyperoodon. Figure below. Turner Collection.



35. **Skin** of Hyperoodon. A portion of the superficial thin pigmented layer of cuticle has been reflected to show the deeper layer attached to the cutis vera. Goodsir Collection.

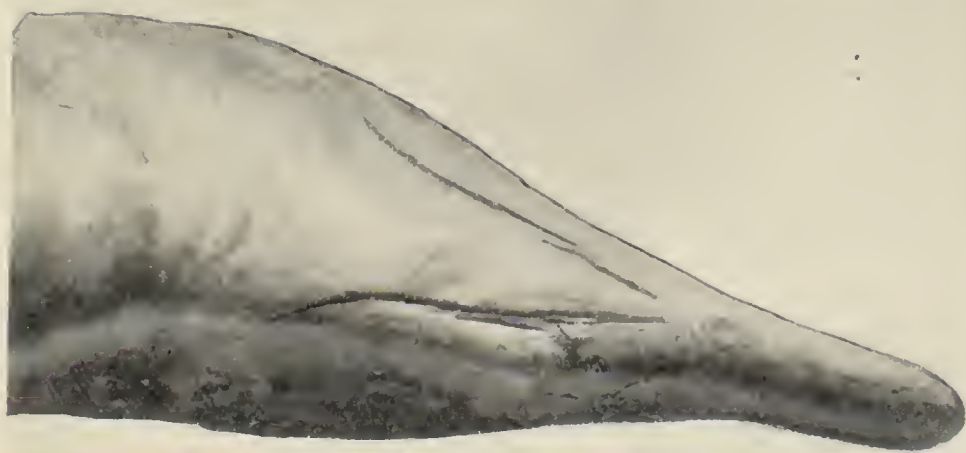
V. MESOPLONDON. (Me.)

Mesoplodon, *Gervais, Ann. Sc. Nat.*, 1850.

Skull with mesethmoid ossified in adult into a medio-rostral bone. Beak long and narrow. No maxillary crests; nasals narrow, concave forwards, lodged between the upper ends of premaxillæ. Pair of large teeth in mandible at some distance from the tip. Sternum consists of four or five pieces. Skull asymmetrical.

(1) MESOPLODON BIDENS. (ME. S.)

(Sowerby's Whale.)

Physeter bidens, Sowerby, *British Miscellany*, 1806.*Delphinus Sowerbiensis*, De Blainville, *Nouv. Dict. d'Hist. Nat.*, 1817.*Delphinarynychus micropterus*, F. Cuvier, *Hist. Nat. des Cétacés*, 1836.*Micropteron bidens*, Eschricht, *Ann. Mag. Nat. Hist.*, 1852.

Colour bluish slate on dorsum, light slate or grey on ventral surface, mottled with white scattered spots. Length 15 to 16 feet. Mandibular teeth triangular, compressed laterally, opposite posterior end of symphysis; two grooves in submandibular region.

1. **Skull.** Cast of the type skull, imperfect, described by James Sowerby in 1806 from the specimen stranded in 1800 near Brodie House, Moray Firth. The animal was a male, and the beak, the anterior part of the cranium, and the mandible are preserved in the Museum of the University of Oxford.

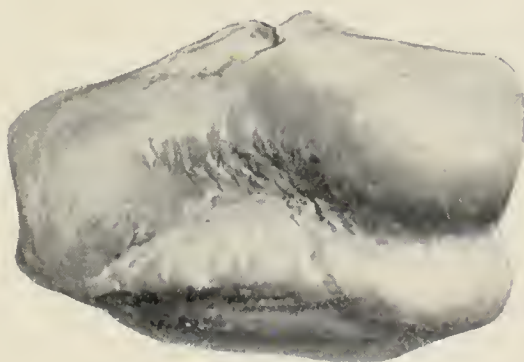
Donor—Sir H. W. Acland, Bart.

[Nos. 2 to 17 are from the Turner Collection.]

2. **Skeleton**, articulated, with caudal fin, pelvic bones, mandible, and hyoid. Whale caught in Voxter Voe, Shetland, June 1885; an adult male, 15 feet 8 inches long. Skull 30 inches long, beak $20\frac{1}{8}$ inches long; medio-rostral ossified. Vertebral formula $C_7D_{10}L_{11}Cd_{19}=47$. Described by Sir Wm. Turner, *Journ. Anat. and Phys.*, vol. xx., 1885. Donor—Dr C. A. Anderson.
3. **Skeleton**, articulated, with dorsal and caudal fins, mandible, and hyoid. Caught in Dalgety Bay, Firth of Forth, October 1888: male, 15 feet 1 inch long; weight 18 cwt. See Turner in *Proc. Roy. Phys. Soc. Edin.*, vol. x., 1889, and *Journ. Anat. and Phys.*, vol. xxiii., 1889. Donor—The Earl of Moray.
4. **Skull**, with mandible. The whale, 14 feet long, an adult male, was stranded at Urafirth Voe, Shetland, in April 1881. Breadth of skull $11\frac{1}{4}$ inches; breadth of beak $7\frac{1}{8}$ inches. Tip of slender beak broken, medio-rostral ossified. See Turner, *Journ. Anat. and Phys.*, vol. xvi., April 1882. Donor—Thos. Anderson, Esq.
5. **Skull**, with mandible; approximate length 2 feet 7 inches, breadth $11\frac{1}{2}$ inches. Beak 19 inches long, breadth at base $7\frac{5}{8}$ inches, slightly curved at tip, medio-rostral ossified for 8 inches; right side, back of skull, and mandible broken.
Morrison's Haven, Firth of Forth, 1895.



6. **Tympano-periotic** bones, right, from the Shetland skull, June 1885, No. 2. Length $1\frac{3}{4}$ inch, breadth 1 inch, height 1 inch. Stapes not ankylosed. The Tympanic has the outer surface moderately convex, marked by a vertical groove into a large anterior and smaller posterior divisions, the anterior being $1\frac{1}{8}$ inch in length. Lip-like process extending down outer surface. Inner surface, $\frac{3}{4}$ inch deep, is faintly striated and not sharply divided into an anterior and a posterior part, but gradually diminishes in thickness from behind forwards. The inferior aspect is bilobed at posterior end, the outer being larger than the distinct inner lobe; the groove of separation expands anteriorly into a shallow roughened fossa; from its breadth this aspect forms an inferior surface; the cavity opens close to the anterior end of this surface. See figure of inferior surface. The Periotic is $1\frac{3}{4}$ inch long and $\frac{7}{8}$ inch broad. See Turner, *Journ. Anat. and Phys.*, vol. xx., 1886.



7. **Tympano - periotic** bones, right, detached from the Morrison's Haven skull, No. 5. The stapes is not ankylosed to the periotic bone.
8. **Periotic** bone, left, from No. 4. Stapes *in situ* but not ankylosed.
Shetland, 1881.
9. **Tympano-periotic** bones, left, from No. 3. Stapes not ankylosed to periotic.
Firth of Forth, Dalgety Bay.
10. **Tooth** extracted from mandible and vertically cut to obtain slices for microscopic examination. Described and figured by Turner in the *Challenger Reports*, vol. i., 1880. Challenger Collection.
11. **Teeth**, casts of two mandibular, of Sowerby's Whale, probably adult.

12. **Vertebræ**, seven cervical, atlas and axis fused; ten dorsal vertebræ; only five pairs of ribs present. Sternum with five segments and four intersegmental foramina. From No. 4.

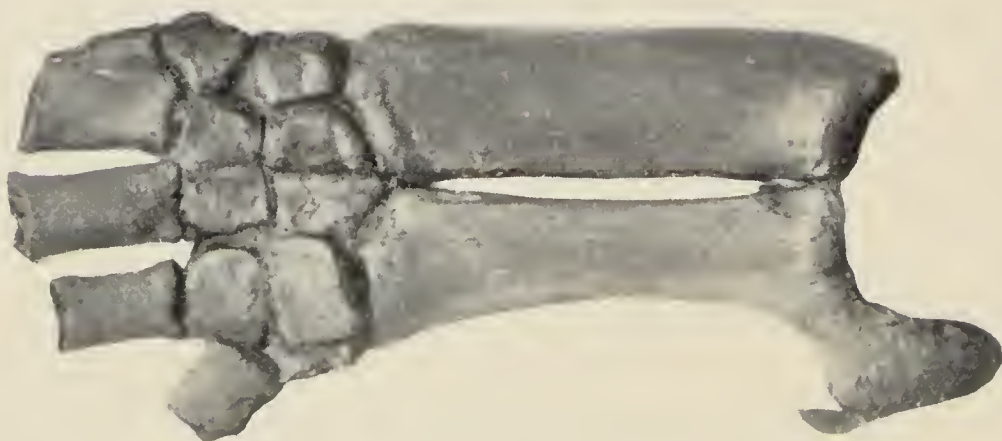
Shetland, 1881.

Turner Collection.

13. **Pectoral Limb**, articulated bones of left. The manus is a natural skeleton. The carpus consists of radiale, intermedium, ulnare, with three disto-carpalia which represent C_1 , C_{2+3} , C_{4+5} . The digit formula is MPh_1 for pollex, MPh_5 , MPh_3 , MPh_3 , MPh_2 for the other digits. From No. 5.

Morrison's Haven, 1895.

Turner Collection.



14. **Pectoral Limb**, left, inner surface dissected. The carpo-metacarpal region is described and figured in Turner's



memoir on Sowerby's Whale, *Proc. Roy. Soc. Edin.*, 1909, vol. xxix. p. 719, where by an error it is ascribed to the specimen from Morrison's Haven. Figure on p. 90.

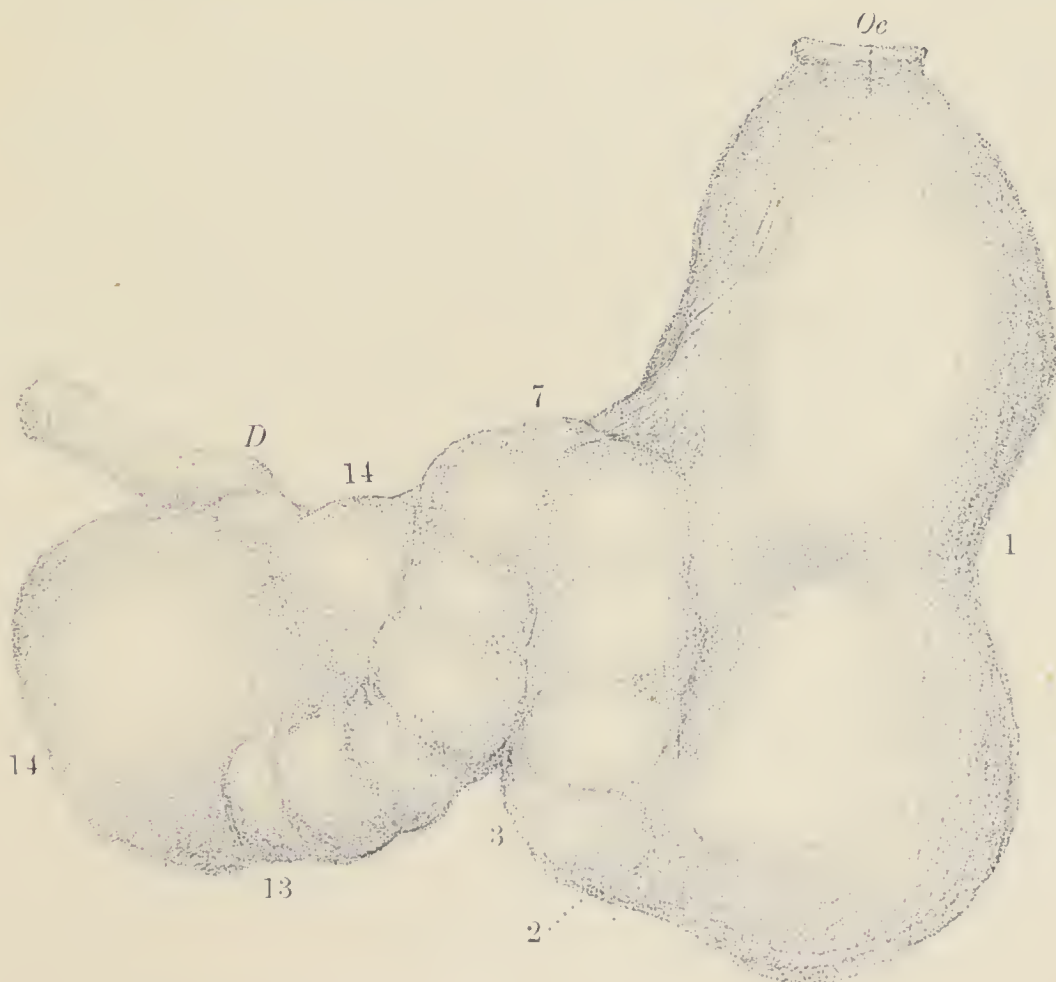
Nairn, Moray Firth, September 1899.

Donor—Wm. Taylor, Esq., Lhanbryde.

15. **Trachea** and bronchi of Sowerby's Whale dried and spread out to show the divisions and subdivisions of the bronchi. Dissected by Dr Charles A. Anderson. From the Shetland specimen, 1885.

Turner Collection.

16. **Stomach** of Sowerby's Whale, Dalgety Bay, 1888, dried and inflated, No. 3. The first compartment (1) is not a paunch, and, though receiving the œsophagus, *Oe*, corresponds with the cardiac compartment (2) in the dolphins; succeeding it are twelve subglobular compartments (2-13) which are arranged to form a Λ -shaped figure; the separation between them is marked on the surface by constrictions, whilst internally broad folds of mucous membrane with valve-like openings project into the lumen. The last (13) opens into the distal or pyloric compartment (14), and it again



opens into the Duodenum, which receives the conjoined Pancreatico-hepatic duct. See Turner in *Journ. Anat. and Phys.*, vol. xxiii., 1889, and figure on p. 91.

17. **Stomach.** Section through the junction of the œsophagus with the 1st compartment of the stomach. The mucous membrane of the œsophagus is raised in fine longitudinal folds, and is covered by squamous epithelium: that of the stomach is raised into broad convoluted folds covered by columnar epithelium; it contains tubular branched glands with peptic and axial cells, and is a true digestive stomach. The œsophagus again is not glandular. See Turner, *Journ. Anat. and Phys.*, vol. xx., 1886.

(2) MESOPLODON LAYARDI. (ME. L.)

(Layard's Mesoplodon.)

Ziphius layardi, Gray, *Proc. Zool. Soc.*, 1865; *Cat. Seals and Whales*, p. 353.

The most prominent specific character is the pair of strap-like mandibular teeth, which in the adult curve upwards and inwards around the sides to above the beak and restrict the opening of the mouth.

1. **Skeleton**, immature, vertebral plates not fused, mandibular teeth not erupted, medio-rostral not ossified. Length of skeleton about 12 feet; length of skull 25 inches, breadth 11 inches; length of beak $14\frac{1}{2}$ inches, breadth 4 inches. The whale was said to be 14 feet long: black above, greyish white below. Vertebral formula $C_7D_9L_{10}Cd_{18}=44$. Bones of limbs absent. See Turner in *Challenger Reports*, vol. i., 1880.

Port Sussex, East Falkland Island, 1875.

Challenger Collection.

2. **Mandible**, with Maxillary Beak, Cast of; medio-rostral ossified. Strap-like mandibular teeth characteristically curved at the sides and above the beak. Original in Museum of University of Oxford. See Turner in *Challenger Reports*, vol. i., 1880.

Walwick Bay, South Africa, 1869.

Donor—Oxford Museum.

3. **Tooth**, Cast of mandibular, removed from socket. The broad strap-like fang and the body of the tooth with the minute triangular crown are well seen. Original

in Museum of University of Oxford. See Turner in *Challenger Reports*, vol. i., 1880.

Donor—Oxford Museum.

4. **Tooth**, right mandibular, removed from the mandible of the young skull from East Falkland Island. A section was made, from which slides for microscopic examination were obtained. See Turner in *Challenger Reports*, vol. i., 1880. Challenger Collection.

5. **Tympano-periotic** bones, right, from the young skull from East Falkland Island, No. 1; stapes in place. Tympanic, length $1\frac{3}{4}$ inch, breadth $1\frac{1}{8}$ inch, height $\frac{7}{8}$ inch. Outer surface flattened behind, moderately convex in front, unequally divided by an almost vertical groove, from which to the anterior border is $1\frac{1}{8}$ inch, to posterior border $\frac{7}{8}$ inch; lip-like process prolonged down outer surface. Inner surface moderately striated, vertical diameter $\frac{3}{4}$ inch behind diminishing towards Eustachian end. Inferior aspect bilobed posteriorly, outer lobe smooth and rounded, larger than the rough and laterally compressed inner; the lobes are separated by a groove which widens out anteriorly to $\frac{5}{8}$ inch as a shallow roughened fossa, so that this aspect deserves the name of inferior surface; the cavity opens by a wide mouth at its anterior end.

Compared with the tympanic of Sowerby's Whale, the outer lobe is smoother and more rounded, and the groove separating it from the inner is wider, but it does not extend so far forwards, and the inner surface turns more abruptly from the inferior surface.

The Periotic is $1\frac{8}{10}$ inch long, $1\frac{3}{10}$ inch broad; the meatus internus is a single canal. See Turner in *Challenger Reports*, vol. i., 1880.

Challenger Collection.

VI. BERARDIUS. (Br.)

Length about 30 feet. Two compressed pointed teeth on each side of mandibular symphysis. Beak long and narrow, medio-rostral partially ossified. Only one species from the New Zealand seas is recognised.

Berardius arnuxi, *Duvernoy, Ann. Sci. Nat.*, 1851.

No specimen in Museum.

Family II. PLATANISTIDÆ.

(Fresh-water Cetacea.)

Jaws long, laterally compressed, with numerous teeth and long symphysis. Pectoral limbs broad, truncated at free end, pentadactylous.

I. PLATANISTA. (Pl.)

Platanista, *Wagler, Nat. Syst. Amph., etc.*, 1830.

Skull with large plate-like maxillary crests; beak slender, with numerous teeth. No dorsal fin, but a low dorsal ridge. Palatines not entering into hard palate.

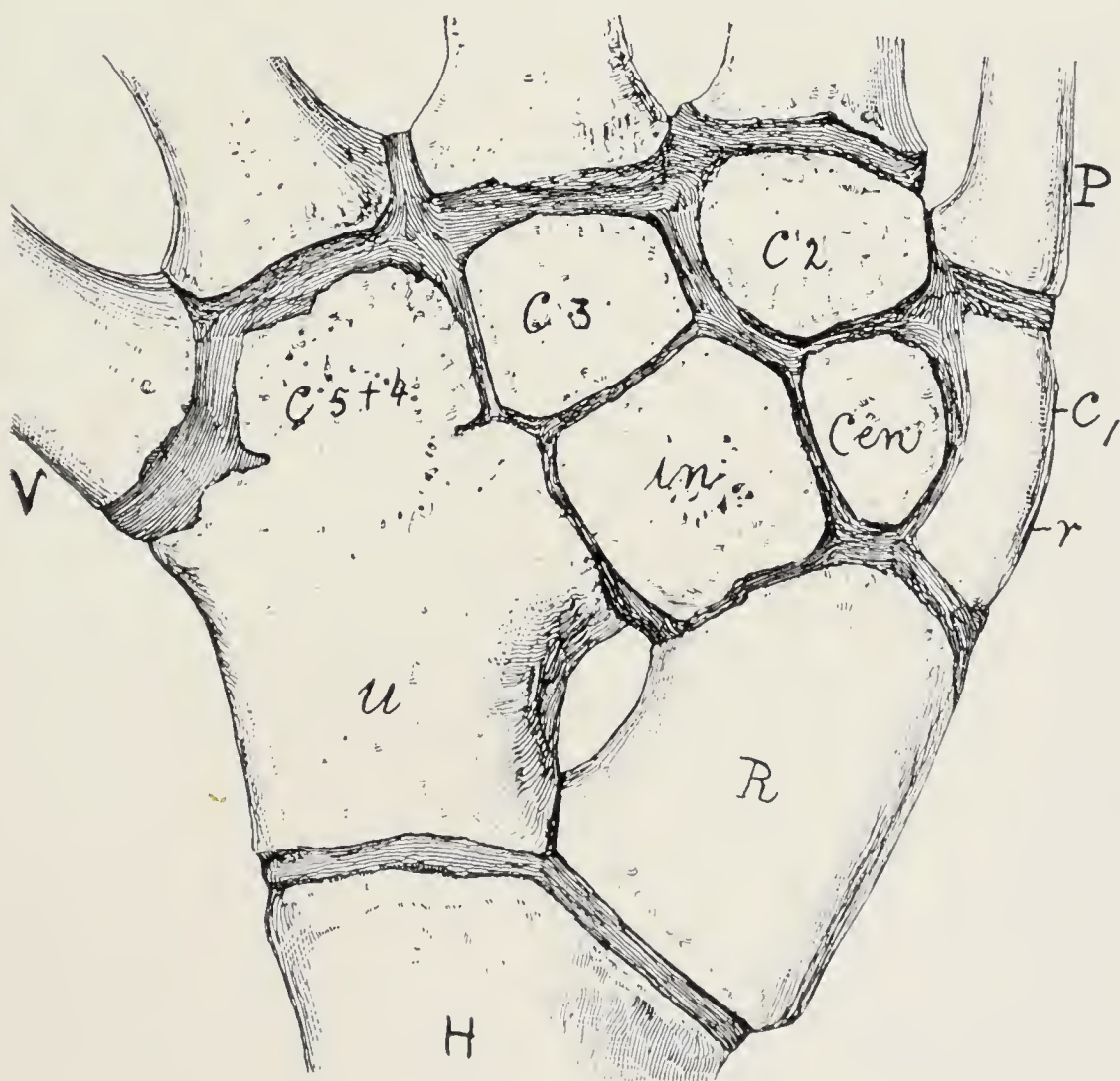
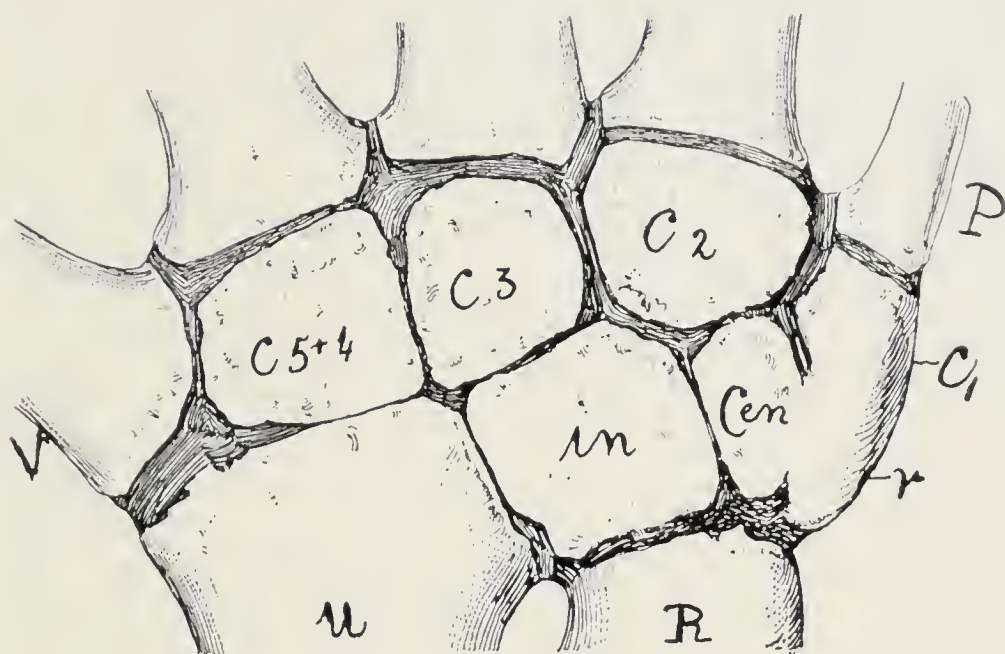
(1) PLATANISTA GANGETICA. (Pl. G.)

(Gangetic Dolphin or Soosoo.)

Length about 8 feet. Eyes diminutive; teeth about $\frac{30}{30}$ $\frac{30}{30}$,

beak very narrow. Vertebral formula $C_7D_{10}L_9Cd_{26}$ = 52. Sternum consists of three transverse segments. Frequents Ganges, Brahmaputra, and Indus rivers.

1. **Skeleton**, articulated, male, length 6 feet; length of beak $12\frac{1}{2}$ inches, breadth at base $1\frac{1}{2}$ inch. An elaborate description of the anatomy of the Dolphin of the Ganges has been given by Dr John Anderson in his *Anatomical and Zoological Researches*, 1878. Carpus figured in Plate XI. Donor—Dr John Anderson, F.R.S.
2. **Skeleton**, articulated, female; length of beak $18\frac{1}{4}$ inches, breadth at base $1\frac{1}{2}$ inch. Spine injured and bent laterally at junction of lumbo-caudal region.
Donor—Dr John Anderson, F.R.S.
3. **Skull**, incomplete; length $12\frac{1}{2}$ inches: length of beak 8 inches; breadth at base 1 inch. Mandible $10\frac{1}{2}$ inches long; symphysis $6\frac{3}{4}$ inches. The skull is that of a young animal. Knox Collection, No. 105.
4. **Skull**, with mandible. The beak and fronto-maxillary region are invested by the dried skin. Teeth longer in front than behind, equal in number in each jaw. Maxillary crests meeting mesially on vertex. Length of skull $18\frac{1}{2}$ inches. Length of beak from maxillary fold of skin $9\frac{1}{2}$ inches. Caught at Cawnpore, 1880.
Donor—Major G. Logan, H.M. Indian Army.

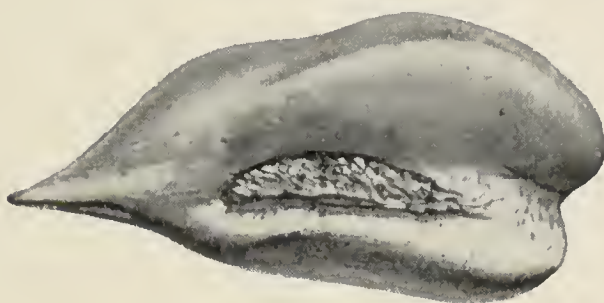


Platanista gangetica, . Manus.



Platanista gangetica. Manus.

5. **Tympanic** bones, pair of, also a single right bone. Length 2 inches, breadth $1\frac{1}{8}$ inch, height $1\frac{1}{8}$ inch. Outer surface with narrow groove for division into two flattened prominences, almost equal in length; lip-shaped process thickened, prolonged down outer surface. Inner surface $\frac{5}{8}$ inch in its posterior two-thirds, then rapidly diminishing to pointed end. Bilobed; a groove extends forward along the greater part of the inferior surface and contains a rough ridge $\frac{3}{4}$ inch long; the surface ends in a pointed process, above which is the Eustachian opening. See figure below.



6. **Head**, sagittal section of a young male, showing the brain *in situ*. The beak has been removed.
Donor—Dr Nelson Annandale.
7. **Caudal** fin of a young male, showing the mesial notch in the posterior border. Donor—Dr N. Annandale.
8. **Pectoral** limbs, pair of, young male, showing the form and the truncated free end. The proximal row of the carpus consists of radiale (*r*), which may be separate or fused with carpale i., of intermedium (*in*), the ulnare being absent; the distal row has Carpale₁, C₂, C₃, C₄₊₅; a centrale is also present; the digits are as follows: MPh₂ for pollex, then MPh₅, MPh₄, MPh₄ and MPh₄ for minimus. X-ray photos figured by Turner in *Proc. Roy. Soc. Edin.*, vol. xxx., 1900, along with other varieties of the manus in Platanista. See Plates XI., XII.
Donor—Dr N. Annandale.

II. INIA. (In.)

Inia, *D'Orbigny, N. Ann. Mus. Paris*, iii., 1834.

Only three lumbar vertebræ. Sternum a single segment. Maxillary crests small, dorsal fin rudimentary, palatines separated by vomer, very long

mandibular symphysis. Only one species, *Inia geoffrensis*; frequents the Amazon river.

No specimen in Museum.

III. PONTOPORIA. (Po.)

Pontoporia, *Gray, Zool. Erebus and Terror*, 1846.

Teeth most numerous, palatines separated by vomer, sternum in two segments. Dorsal fin falcate. Only one species, *Pontoporia blainvilli*; frequents the Rio Grande and the La Plata river.

No specimen in Museum.

Family III. DELPHINIDÆ.

(Dolphins.)

Usually small, seldom exceeding 20 feet. Teeth usually in both jaws, frequently numerous; sternal ribs ossified; lachrymal conjoined with malar bone; pentadactylous. Skull not quite symmetrical.

I. MONODON. (Mo.)

Monodon, *Linnaeus, Syst. Nat.*, 1766.

One tooth in superior maxilla of male, forming a spirally twisted tusk, rarely two protruded teeth. No dorsal fin. Manus short, narrow. Premaxillæ convex in front of nares, broad and flattened in beak.

(1) MONODON MONOCEROS. (Mo. M.)

(Narwhal, Sea Unicorn.)

Monodon monoceros, *Linnaeus, supra cit.*

Colour dark grey above, white below, marbled with grey spots; horn-like tusk several feet long, spirally twisted. Head rounded, without distinct beak. Length less than 16 feet. Vertebral formula $C_7D_{11}L_6Cd_{26}=50$.

1. **Skull**, adult, $23\frac{1}{2}$ inches long, greatest breadth 16 inches. Beak $13\frac{1}{2}$ inches long, $10\frac{1}{4}$ inches broad at base. Pre-

maxillæ convex and thick at nasal end, in the beak smooth, flattened, $2\frac{3}{8}$ inches at the broadest, but broad almost to tip. Superior maxillæ rougher, distinct external to premaxillæ. Vertex cranii in same plane as top of nasals. Pterygoids relatively small, meeting mesially. No tusks protrude, and the sockets are filled with bone. $2\frac{1}{4}$ inches behind the right socket is seen the tip of a rudiment of a second maxillary tooth lying at the bottom of its socket. A similar socket in the left maxilla has no rudimentary tooth in it. Mandible absent. Goodsir Collection.

2. **Skull**, with left tusk, which protrudes 3 feet. Right maxilla removed. No mandible.

Goodsir Collection.

3. **Skull**, young female, $13\frac{1}{4}$ inches long, 9 inches broad; beak 6 inches long, $4\frac{1}{2}$ inches broad at base. Naso-premaxillary region similar to though less strongly marked than in No. 1. Pterygoids separated by a wide cleft mesially. Tympano-periotics retained in skull. Mandible 10 inches long, symphysis 1 inch. The right and left tusks have each reached the mouth of the alveolus, but have not protruded. One inch behind the right alveolus is a smaller socket in which the end of an aborted tooth is seen; a similar left socket does not contain an aborted tooth.

Davis Strait.

Donor—Sir John Struthers, 1895.

4. **Skull**, male, adolescent, $18\frac{1}{4}$ inches long, 12 inches broad; beak 9 inches long, 7 inches broad; naso-premaxillaries assuming adult characters; pterygoids partially united mesially; tympano-periotics *in situ*. Mandible 14 inches long, symphysis $1\frac{3}{8}$ inch. Left tusk projects for $1\frac{3}{4}$ inch, right is concealed. Behind each alveolus is a depression which may have lodged a rudimentary tooth.

Davis Strait.

Donor—Sir John Struthers, 1895.

5. **Skull**, 20 inches long, $13\frac{1}{2}$ inches broad; beak $10\frac{1}{4}$ inches long, $7\frac{1}{2}$ inches broad. Right tympano-periotics *in situ*. Mandible $16\frac{1}{2}$ inches long, symphysis 2 inches. The left tusk protrudes $11\frac{1}{2}$ inches. The rudimentary right tusk is entirely concealed.

Donor—T. Graham Kerr, Esq.

6. **Skull**, bones of foetal, disarticulated; the foetus was removed in December 1875 from a gravid uterus, No. 22.

In this specimen the superior maxilla is $8\frac{1}{2}$ inches long; each contains a non-protruded tusk, behind which is an aborted tooth $\frac{1}{2}$ inch long and $\frac{2}{10}$ inch wide enclosed in a distinct sac. Described by Turner, *Proc. Roy. Soc. Edin.*, vol. ix. p. 110. Also in vol. vii. p. 760, a description is given of a foetus $7\frac{1}{4}$ inches long, with two dental papillæ imbedded in the gum, one in front of the other. The figure below, of a longitudinal section through the gum, magnified, shows their relative position.



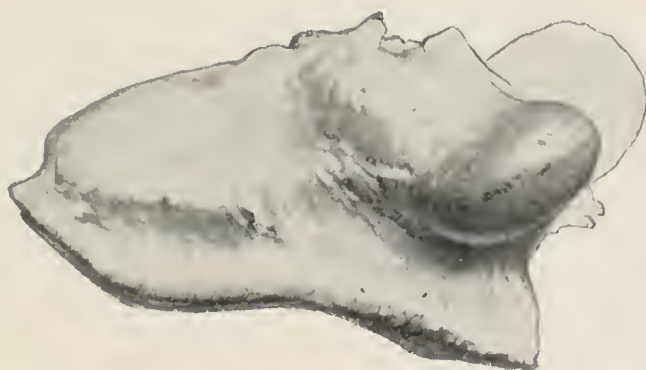
7. **Skull** of foetus, disarticulated; the socket of each superior maxilla contains a concealed tusk; a little further back is a second socket, in which a corresponding tooth is not present. Turner Collection.
8. **Vomer**, spout-like, with mesethmoid cartilage occupying the interval between the two lateral halves and extending for 3 inches in front of the tip of the bone; from the foetal skull No. 6. Turner Collection.
9. **Mandible** without skull. No teeth or alveoli. Goodsir Collection.
10. **Tusk**, 6 feet 10 inches long: spiral surface pronounced. Donor—Sir Douglas Maclagan.
11. **Tusk**, 6 feet $9\frac{1}{2}$ inches long; spiral arrangement pronounced. Donor—Sir Douglas Maclagan.
12. **Tusk**, 5 feet $6\frac{1}{2}$ inches long; spiral arrangement of surface very strong. Goodsir Collection.

13. **Non-protruded** tooth of the Narwhal, $7\frac{1}{4}$ inches long; spiral arrangement not developed, free end pointed, opposite end 1 inch wide, hollowed as if it had lodged a large dentar papilla.

Donor—Prof. W. C. McIntosh, F.R.S.

14. **Tympano-periotic** bones, left, articulated, of an adult; length of tympanic bulla $2\frac{1}{8}$ inches, breadth 1 inch, height $\frac{7}{8}$ inch; outer and inner surfaces with deep indentation; inferior surface two-lobed posteriorly, separated by a wide deep cleft; outer lobe smooth, rounded, much more prominent than inner, blends with outer surface; inner lobe continuous with strong ridge which separates inner from inferior surface; cavity opens by wide mouth close to anterior end of this surface. Surface in front of cleft rough. (Figure of inferior surface below.) Periotic $2\frac{1}{4}$ inches long, $1\frac{1}{8}$ inch broad; meatus wide.

Turner Collection.



15. **Tympano-periotic** bones, left, of a foetus, fused; tympanic bone $1\frac{7}{8}$ inch long; chain of tympanic ossicles *in situ*.

Turner Collection.

16. **Sternum** of an adult, length 12 inches, breadth of manubrium 11 inches. A round mesial foramen lies between the second and third segments; articulations for five pairs of ribs. Deep presternal notch.

Goodsir Collection.

17. **Pectoral** Limb of Narwhal, right; humerus $5\frac{7}{8}$ inches long, radius $4\frac{3}{4}$ inches, ulna $5\frac{1}{8}$ inches; epiphyses fused. Carpus with radiale, *r*, intermedium, *i*, ulnare, *u*; the intermedium has fused with it a nodule which may be an os centrale; C_1 , C_{2+3} and C_{3+4} are distinct bones. The digits are MPh_2 for pollex, *p*, MPh_4 , MPh_4 , MPh_2 , MPh_2 , minimus, *V*. Radiogram on page 100.

Struthers Collection.



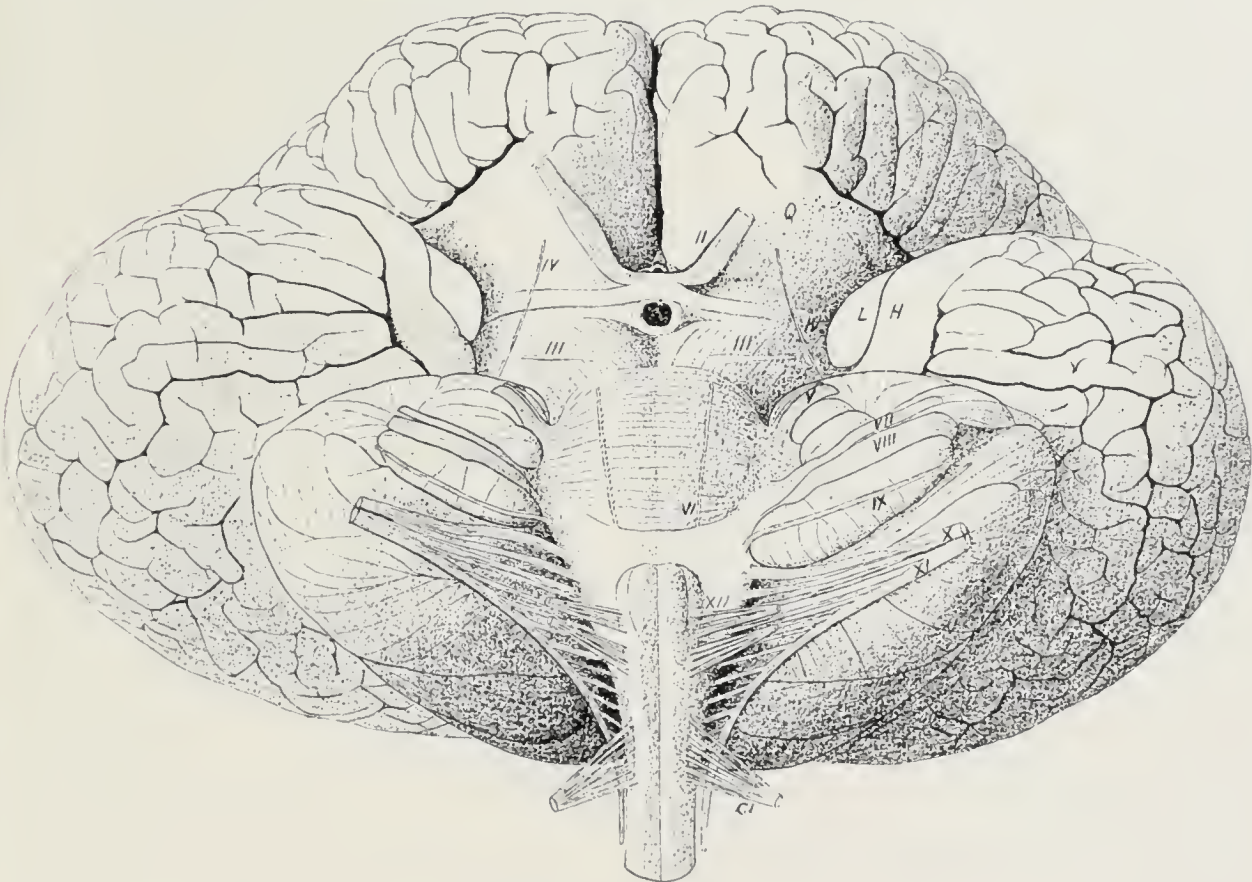
18. **Pectoral** Limbs, pair of ; humerus $5\frac{1}{2}$ inches long ; radius, R, $4\frac{1}{8}$ inches long, 17 inches broad ; ulna, U, $5\frac{1}{4}$ inches long, $1\frac{3}{8}$ inch broad ; epiphyses fused. Carpus with radiale, r, intermedium, ulnare ; in one the distal carpalia are C_1 , C_{2+3} , and C_{3+4} ; in the other C_1 is not visible. Metacarpals i. to v. P, pollex. Phalanges imperfect.

19. **Brain** of Narwhal, the basal surface, LH, lobus hippocampi, the *area desert* Q, the absence of olfactory peduncles and bulbs, and the origin of the nerves shown in Plate XIII. The convoluted cranial surface of the left hemisphere is figured in Plate XIV. : also by Turner in "The Convolution of the Brain," in *Journ. Anat. and Phys.*, vol. xxv., 1891.

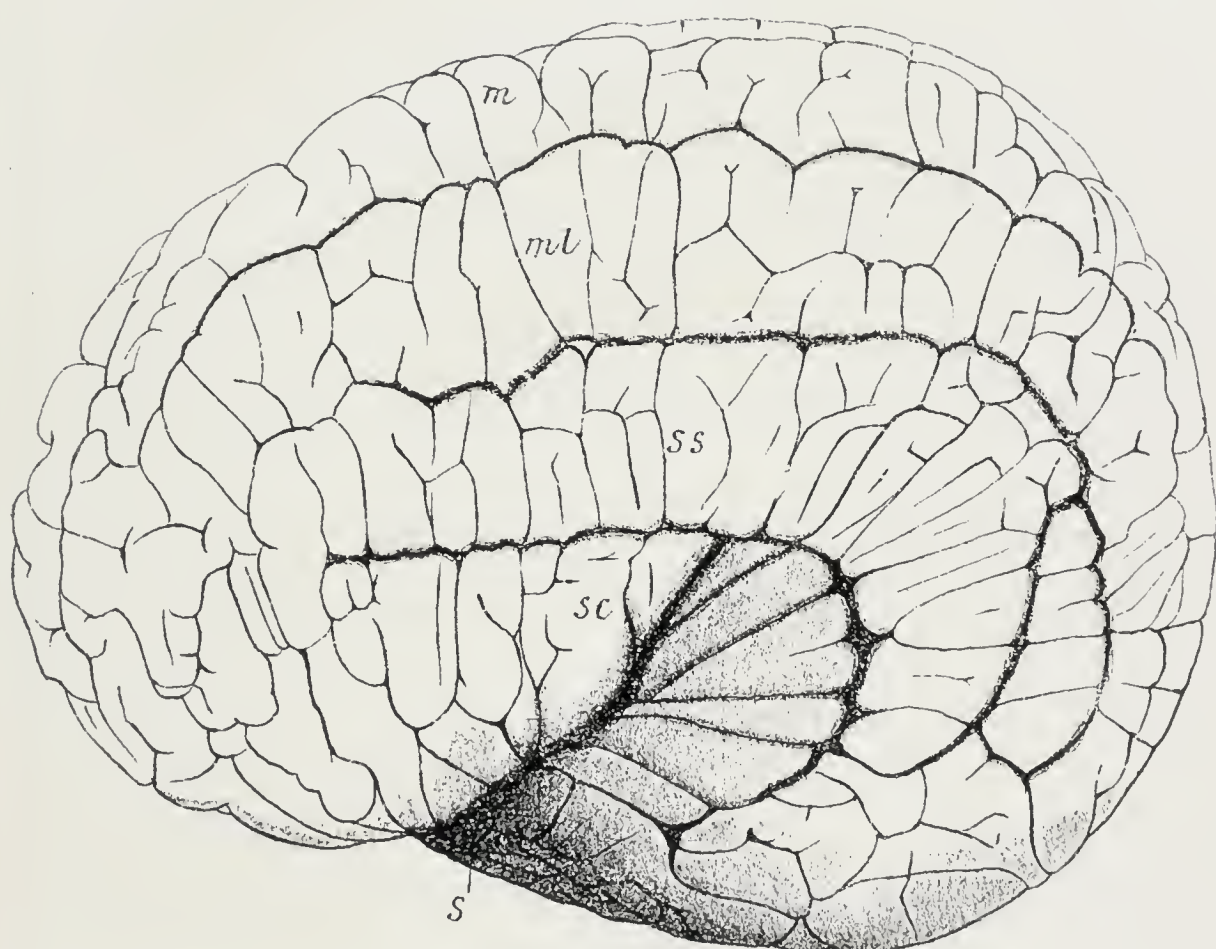
Donor—Dr H. Season Wilson.

20. **Brain**, a female about 17 feet long : weighed 3 lb. 15 oz. before being placed in spirit.

Donor—Sir John Struthers, 1895.



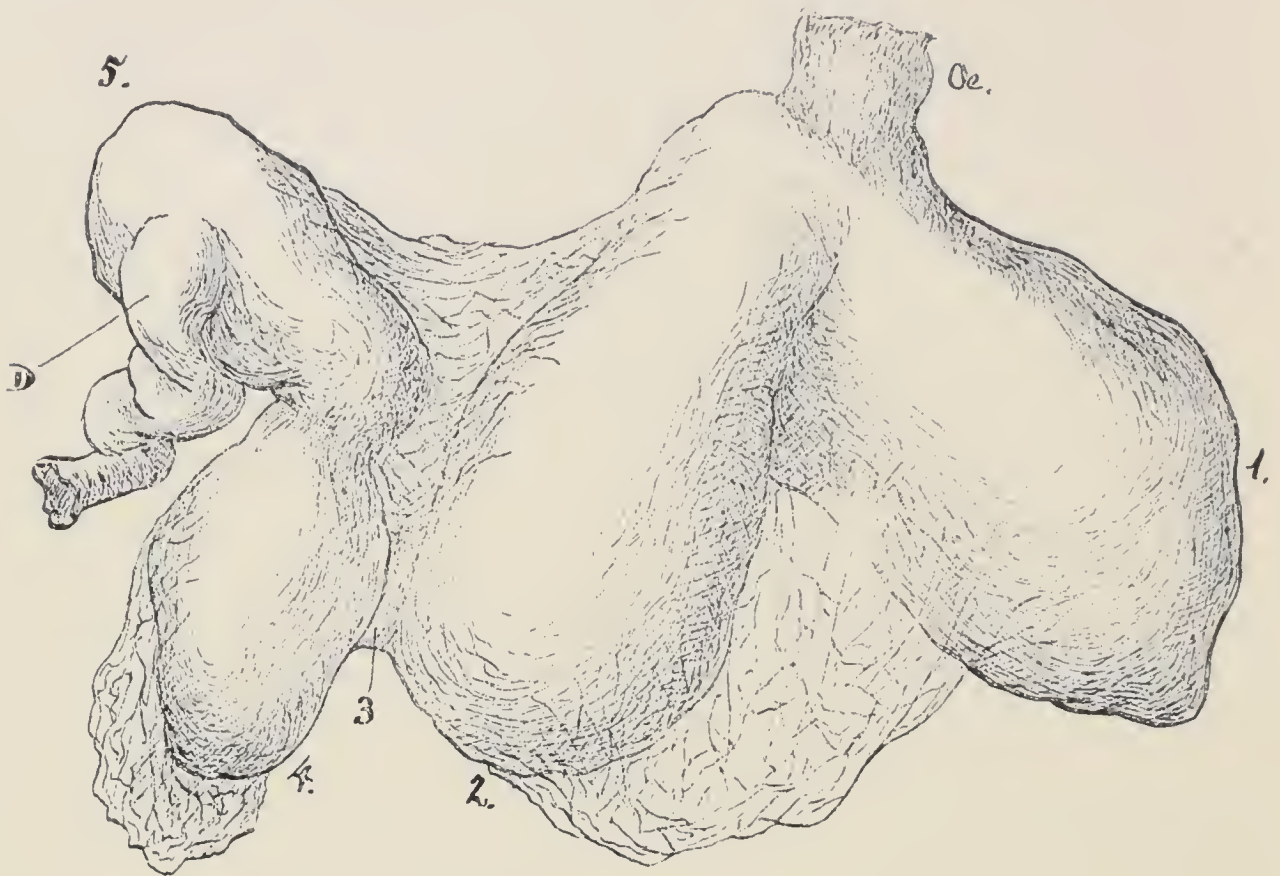
Monodon monoceros.



Monodon monoceros.

S, Sylvian fossa and fissure ; *sc*, Sylvian convolution ; *ss*, supra-Sylvian ;
ml, medi-lateral convolution ; *m*, marginal convolution.

21. **Brain**, without the membranes, divided into three portions, removed from skull by Dr Robert Gray. Weight 3 lb. 12 oz.
Donor—Sir John Batty Tuke, M.P.
22. **Placenta**. A portion of the wall of the pregnant uterus of the Narwhal, showing the crypts in which the villi of the chorion, injected red, are lodged. This and the other preparations of the placenta are from the specimen described by Sir Wm. Turner in *Proc. Roy. Soc. Edin.*, vol. ix., 1876.
23. **Placenta**. A portion of the pregnant uterus of the Narwhal, showing the relationship of the villous surface of the chorion, injected blue, to the uterine mucosa (red); a part of the chorion has been reflected from the mucous membrane.
24. **Placenta**. Pole of the chorion of the fecundated cornu, showing the diffuse arrangement of the villi, the vessels of which are not injected.
25. **Placenta**. Pole of the chorion of the Narwhal, from the cornu opposite to that occupied by the foetus; villi minutely injected red.
26. **Placenta**. A portion of the chorion of the same animal, showing the non-villous area opposite the os uteri internum surrounded by villi injected red.
27. **Placenta**. A portion of the umbilical cord of the Narwhal, showing the amniotic corpuscles.
28. **Placenta**. A portion of the cervical end of the pregnant uterus, the os uteri externum and the vagina of the Narwhal, showing the folds of the mucous membrane. Not injected.
29. **Stomach**, figure of foetal, from a specimen 5 feet 1 inch long. The oesophagus, *Oe*, communicated with the paunch, 1, which opened close to the oesophagus into a large compartment 2, succeeding which was a small compartment 3, then a larger 4, that opened into the pyloric compartment 5, from which the duodenum *D* proceeded. See Turner's description in *Journ. Anat. and Phys.*, vol. xxiii., 1889. Figure on page 102.



II. DELPHINAPTERUS. (Dpt.)

Delphinapterus, *Lacépède, Hist. Nat. Cétacées*, 1804.

Beluga, *Gray, Spic. Zool.*, 1828.

Teeth, eight to ten in the anterior part of each jaw, truncated when worn; premaxillæ flat or faintly concave in front of nares. Forearm and manus short, broad; no dorsal fin.

(1) DELPHINAPTERUS LEUCAS. (DPT. L.)

(Beluga or White Whale.)

Physeter catodon, *Linnaeus, supra cit.*

Delphinus leucas, *Pallas, Reise*, 1776.

Balæna albicans, *Müller, Zool. Dan. Prodr.*, 1776.

Beluga catodon, *Gray, Zool. Erebus and Terror*, 1846.

Colour white; 16 to 20 feet long; cervical vertebrae not fused, formula C_7D_{11} or $_{12}L_9Cd_{23} = 50$ or 51 ; neck distinct on surface.

1. **Skull**, adult, length 20 inches, breadth 11 inches; beak, length $10\frac{1}{2}$ inches, breadth 7 inches. Nasal end of premaxillaries almost flat, comparatively thin; $1\frac{7}{8}$ inch broad in line with base of beak, convex, and retaining convexity until near tip. Superior maxillæ

form outer part of beak. Vertex cranii somewhat higher than nasals. Pterygoids separated by a wide cleft. Teeth oblique and truncated, $\frac{10}{9} \frac{10}{9} = 38$. Mandible $15\frac{1}{2}$ inches long, symphysis $2\frac{1}{2}$ inches long. Tympano-periotics absent. Monro Collection.

2. **Skull**, adult, 23 inches long, breadth 13 inches; beak, length 14 inches, breadth $7\frac{1}{2}$ inches. Premaxillæ faintly concave at nasal end; breadth opposite base of beak $2\frac{1}{3}$ inches, then convex almost to tip, which has a blunt, rounded end. Superior maxillæ distinct. Vertex and upper ends of nasals in same plane. Pterygoids as in No. 1. Teeth oblique, truncated, $\frac{9}{8} \frac{10}{9} = 36$. Mandible $19\frac{1}{2}$ inches, symphysis $3\frac{1}{4}$ inches long. Tympano-periotics absent. Spitzbergen. Lamont Expedition. Donor—Dr A. M. Bentley.

3. **Pectoral Limb**, left. Humerus 6 inches long; radius $4\frac{5}{8}$ inches long, $2\frac{7}{8}$ inches broad; ulna $4\frac{1}{2}$ inches long, $2\frac{1}{2}$ inches broad; epiphyses fused. Carpus with radiale, intermedium, and a cartilaginous ulnare; the distal carpalia are C_1 for pollex, C_2 mainly for $M_{ii.}$, C_3 very small for $M_{iii.}$, and C_4 equally for $M_{iii.}$ and $M_{iv.}$; no independent C_5 . Phalangeal formula: pollex, Ph_1 or $_2$; digit ii., Ph_5 ; digit iii., Ph_5 ; digit iv., Ph_4 ; digit v., Ph_4 . Struthers Collection.

[Tympano-periotic, from specimen in Museum, Royal College of Surgeons, England. Tympanic length $1\frac{8}{10}$ inch, breadth 1 inch, height $\frac{8}{10}$ inch. Outer surface saddle-shaped, lip-like process extending vertically down it; inferior surface bilobed, outer larger, smooth, rounded; inner ridged, rough; cleft deep, extending forward towards anterior end, above which is Eustachian opening. (Figure of inferior surface below.) Periotic $1\frac{1}{2}$ inch long, 1 inch broad; dense labyrinthine part almond-shaped.]



III. PHOCÆNA. (Ph.)

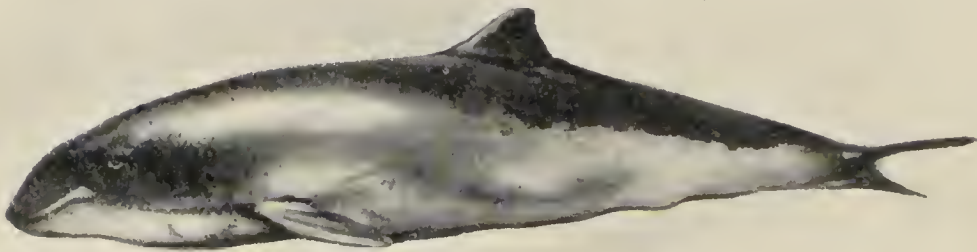
(The Porpoise.)

Phocæna, *Cuvier, Règne Animal*, 1817.

Dorsal fin about middle of back, falcate, triangular, anterior border with low tubercles; pectoral limb ovate, second and third digits nearly equal in length; premaxillæ thickened and convex in front of nares; vertex cranii elevated behind the nasals. Head not beaked; cervical vertebræ mostly fused.

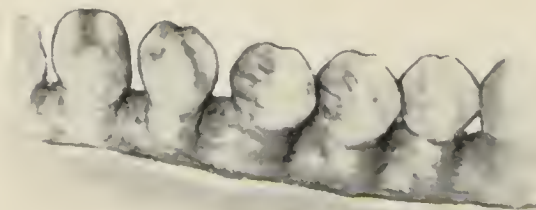
(1) PHOCÆNA COMMUNIS. (Ph. C.)

(Common Porpoise.)



Colour nearly black above, white ventrally. Length from 5 to 6 feet; teeth in both jaws numerous, small, crowns laterally compressed, spade-like, slightly lobed; vertebral formula C_7D_{12} to $_{14}L_{14}$ to $_{15}Cd_{30}$ to $_{33}$ = 64 to 66.

1. **Skeleton**, natural, 3 feet 5 inches long. The teeth are in good order and show the characteristic spade-like form. See figure, magnified, of six teeth in maxilla and in mandible. Goodsir Collection.



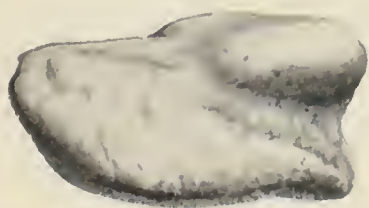
2. **Skeleton**, young, apparently a few days old, $11\frac{3}{4}$ inches long, showing the condition of ossification at the period.

Firth of Forth.

Knox Collection, No. 103.

[Nos. 3 to 13 are from the Collection formed by Sir Wm. Turner.]

3. **Skeleton**, axial, of adult, disarticulated. Skull, hyoid, vertebræ, ribs, sternum. Skull $10\frac{1}{2}$ inches long, breadth $5\frac{1}{2}$ inches; beak $4\frac{3}{4}$ inches long, 3 inches broad at base. Premaxillæ ridged in front of nares and as far as base of beak; breadth in beak $\frac{3}{8}$ inch, faintly convex. Pterygoids small, far asunder. Tympanics *in situ*. Mandible $8\frac{1}{4}$ inches long, symphysis 1 inch.
4. **Skeleton**, disarticulated. Length of skull 10 inches, breadth 5 inches; length of beak $4\frac{1}{4}$ inches, breadth at base $2\frac{1}{2}$ inches.
5. **Skull**, with mandible; skull cap removed.
1875.
6. **Skull**, bisected, no mandible.
7. **Tympano-periotic** bones, right and left, from No. 3. Tympanic bone $1\frac{1}{2}$ inch long, $\frac{3}{4}$ inch broad, $\frac{5}{8}$ inch high; bilobed posteriorly. Periotic $1\frac{1}{8}$ inch long.
8. **Tympano-periotic** bones, left; outer surface with deep notch behind lip-like process for malleus, inner surface with upper border sloping downwards and forwards; bilobed, outer lobe smooth, rounded, inner smaller, flattened laterally, separated by a relatively wide and deep cleft. Inferior surface broad, roughened with definite inner ridge, whilst on the outer side it blends with the outer surface; tympanic cavity opens by a moderate orifice close to the anterior end of this surface. Tympanic $1\frac{1}{4}$ inch long, $\frac{5}{8}$ inch broad, $\frac{1}{2}$ inch high. (Figure of inferior surface below.) Periotic $1\frac{1}{4}$ inch long; stapes attached; meatus large; articular surface for tympanic flat, smooth.



9. **Vertebræ**, cervical, fused together.

10. **Dorsal** fin, dried, falcate; the anterior border is roughened through the presence of low tubercles. From No. 3.
11. **Dorsal** fin of young Porpoise, base $6\frac{1}{3}$ inches, height $2\frac{3}{4}$ inches; anterior border $5\frac{1}{2}$ inches, rough, with about twenty low tubercles projecting from the free border.
12. **Caudal** fin, dried, showing the mesial notch and the concave border to the tip on each side. From No. 3.
13. **Heart** of a well-grown Porpoise, showing well-marked inter-ventricular grooves ending in a definite notch near the apex.
14. **Heart** of a small Porpoise; the cavities and great vessels have been opened into to show the valves.
Goodsir Collection.
15. **Rete mirabile** with heart of Porpoise and the adjacent wall of thorax. The aorta gives origin to a branch which ends in the rete mirabile on the superior wall of the thoracic cavity.
Goodsir Collection.
16. **Larynx** of Porpoise, showing the relation of the windpipe to the nasal chamber. On the inferior surface the hyoid apparatus has been dissected.
Turner Collection.
17. **Larynx** of Porpoise, showing the pyramidal projection of the windpipe, which projects into the nasal chamber: its neck is surrounded by a marked sphincter muscle. Prepared by Dr T. Spencer Cobbold.
18. **Stomach** of Porpoise, inflated and dried. It consists of a paunch-like œsophageal compartment; a cardiac compartment in which are numerous folds of mucous membrane running mostly longitudinally; a small intermediate compartment and a long tubular pyloric compartment, which opens into the dilated commencement of the duodenum. See for microscopic structure Turner's memoir in *Journ. Anat. and Phys.*, vol. xxiii., 1889.
19. **Intestine**, small, of Porpoise inverted and injected. The valvulæ conniventes are arranged longitudinally.
Goodsir Collection.
20. **Kidney** of Porpoise, vessels minutely injected. The numerous small lobules are displayed; the capsule has been removed.
21. **Kidney**, a similar preparation. Goodsir Collection.
22. **Brain** of Common Porpoise exposed in the skull.
23. **Brain** of Common Porpoise cut into sections.

24. **Mamma** of a gravid Porpoise, dissected by Dr David Hepburn; see *Journ. Anat. and Phys.*, vol. xxviii., 1894.
25. **Fœtus**, male, 9 inches long, in spirit. Removed from uterus in December 1892.

IV. CEPHALORHYNCHUS. (CRH.)

Cephalorhynchus, *Gray, Cat. Cetacea*, 1850.

In size and general form approximating to the Porpoise. Skull small, rostrum relatively broad; premaxillæ tuberculated in front of nares and concave on upper surface; teeth small, acute; summit of skull higher than nasals.

(1) CEPHALORHYNCHUS ALBIFRONS. (CRH. A.)

Electra clancula, *Gray, Syn. Whales and Dolphins; Hector, Trans. New Zealand Inst.*, 1873.

Cephalorhynchus albifrons, *F. W. True, Bull. United States Nat. Mus.*, No. 36, 1889.

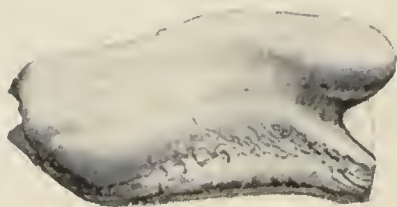
Colour, upper part of body light grey, nose and forehead white, ventral surface white crossed with dark grey stripe. Total length about 5 feet. Skull about 14 inches long, rostrum one-half length of skull; dorsal fin low, ovate; pectoral fin falcate.

1. **Skeleton**, articulated, 3 feet 9 inches long, not adult; pelvic bones and hyoid absent, manus imperfect. Skull $11\frac{1}{4}$ inches long, $5\frac{1}{2}$ inches broad; beak $5\frac{1}{2}$ inches long, $2\frac{3}{4}$ inches broad. Premaxillæ marked at nasal end near the outer border by a longitudinal ridge, internal to which the anterior surface is concave; in the beak this surface is flattened, relatively broad, $\frac{5}{8}$ inch in greatest breadth. The maxillæ form the borders of the beak and are visible as far as the tip. Nasals $\frac{3}{4}$ inch broad at upper end, project upwards for $\frac{1}{2}$ inch. Vertex cranii higher than nasals. Pterygoids separated by a wide cleft. Mandible $8\frac{3}{4}$ inches long, symphysis $\frac{3}{4}$ inch. Teeth, $\frac{29}{29}$ $\frac{29}{29}$, acute; costal cartilages ossified, upper four pairs articulate with sternum. Vertebral formula $C_7D_{12}L_{18}Cd_{27}=64$.
New Zealand. Donor—Sir Jas. Hector, K.C.M.G., 1872.

2. **Tympano-periotic** bones, pair of, articulated. Tympanic, length $1\frac{1}{4}$ inch, breadth $\frac{3}{4}$ inch. Bilobed on inferior surface posteriorly; outer lobe large, somewhat elongated; inner short and narrow: groove of separation prolonged forward on surface, which is defined by a ridge at inner border, whilst at the outer border the inferior surface blends with the external; the cavity opens close to the anterior end of the inferior surface. (Figure of inferior surface below.) Periotic, length $1\frac{1}{4}$ inch; meatus large.

New Zealand.

Donor—Sir Jas. Hector, K.C.M.G.



V. NEOMERIS. (N.)

Neomeris, *Gray, Zool. Erebus and Terror*, 1846.

No dorsal fin. Cranium closely resembles *Phocaena*.

(1) NEOMERIS PHOCÆNOIDES.

Delphinus phocænoides, *Cuvier, Règne Animal*, 1829.

Colour black, but with purplish-red patch on the lip and on the throat. Length about 4 feet. Habitat

India and Japan seas, the Cape. Teeth, $\frac{18}{17} \frac{18}{17}$.

No specimen in Museum.

VI. ORCELLA. (Oc.)

Orcella, *J. Anderson, Proc. Zool. Soc.*, 1871.

Colour pale slate above, whitish below: head blunt, rounded; dorsal fin small, falcate; beak short. Teeth small, acute. Vertebral formula $C_7D_{13}L_{16}Cd_{26}=62$. Length of animal 6 to $7\frac{1}{2}$ feet. One or possibly two species: *O. brevirostris* from the Ganges, Bay of Bengal; *O. fluminalis* from the Irawady river. See detailed description of the latter in Dr John Anderson's *Anat. and Zoolog. Researches*. London, 1878.

(1) ORCELLA BREVIROSTRIS. (Oc. BR.)

Phocaena brevirostris, *Owen, Trans. Zool. Soc.*, vol. vi.

1. **Skull**, adult; length $11\frac{1}{2}$ inches, breadth $7\frac{3}{4}$ inches; beak length 5 inches, breadth at base $4\frac{2}{10}$ inches; mandible, length $8\frac{3}{4}$ inches, height at condylar end 3 inches, length of symphysis $1\frac{4}{10}$ inch. Cranium globose; vertex craniæ on same plane as top of nasals, which are small, $\frac{6}{10}$ inch wide and free for only $\frac{3}{10}$ inch; occipital region arches backwards and downwards. Beak short, wide at base in relation to length. Pre-maxillaries smooth and concave in pre-narial region, then slightly convex and $\frac{8}{10}$ inch broad; mesethmoid visible as far as the end of the concave surface. Maxillæ roughened and forming outer margin of beak, though concealed at the tip. Pterygoids separated mesially by a wide cleft. Palate bones arched from mesial suture outwards and backwards, only $\frac{3}{10}$ inch in antero-posterior diameter. Teeth, only one present in each maxilla, but anterior to it are six empty sockets; indications of sockets much further back, as if the more posterior sockets and teeth disappeared early in life; in the anterior end of each mandible twelve short teeth, conical and worn at the tips. The tympano-periotic bones are absent.

Donor—Dr Nelson Annandale.

VII. ORCA. (O.)

Orca, *Gray, Zool. Erebus and Terror*, 1846.

Colour glossy black on head and back, venter white prolonged into the side, white spot near eye; teeth large; pectoral limb ovate, large. Head broad, depressed; dorsal fin at middle of back, high.

(1) ORCA GLADIATOR. (O. G.)

(Killer Whale or Grampus.)

Delphinus orca, *Linnaeus, Syst. Nat.*, 1766.

Orca gladiator, *Gray, Zool. Erebus and Terror*, 1846.

Colour black on dorsum and sides, white on venter, with a broad white band indenting the black side; dorsal fin at middle of back, very high, falcate,

pointed; pectoral fin ovate, nearly as broad as long. Length 20 to 30 feet, bulky, rapacious; teeth strong, with fangs expanded laterally. Vertebral formula C_7D_{11} or $_{12}L_{10}Cd_{23}=51$ or 52.

1. **Skull**, adult; length 3 feet $1\frac{1}{2}$ inch, breadth $22\frac{3}{4}$ inches; beak 1 foot 9 inches long, 13 inches broad at base. Mandible 2 feet 8 inches long, symphysis $6\frac{1}{2}$ inches. Teeth $\frac{11}{11} \frac{11}{11}$, massive, conical, points blunted; surface of premaxilla in front of nares broad and concave, the concavity extending half length of beak, when the bone flattens, widens out towards tip to $2\frac{3}{8}$ inches. Pterygoids separated by a moderately wide cleft. Summit of nasals slightly higher than ridge on vertex cranii.

Newfoundland, 1877.

Donor—Dr A. J. Harvey.

2. **Skull** of Orca of a herd of nineteen captured in Bressay Sound, Shetland, in February 1871. They varied in length from 17 to 24 feet. Skull 2 feet 8 inches long, $16\frac{1}{2}$ inches broad; beak 17 inches long, 10 inches broad at base. Mandible 26 inches long, breadth at condylar end $7\frac{1}{4}$ inches, symphysis $4\frac{3}{4}$ inches. Teeth $\frac{11}{11} \frac{11}{11}$, conical, not so much worn as in No. 1. Summit of nasals about 1 inch higher than ridge on vertex cranii. Specimens of placenta, Nos. 8 to 14, were from a gravid female of this herd.

Donor—John Gatherer, Esq.

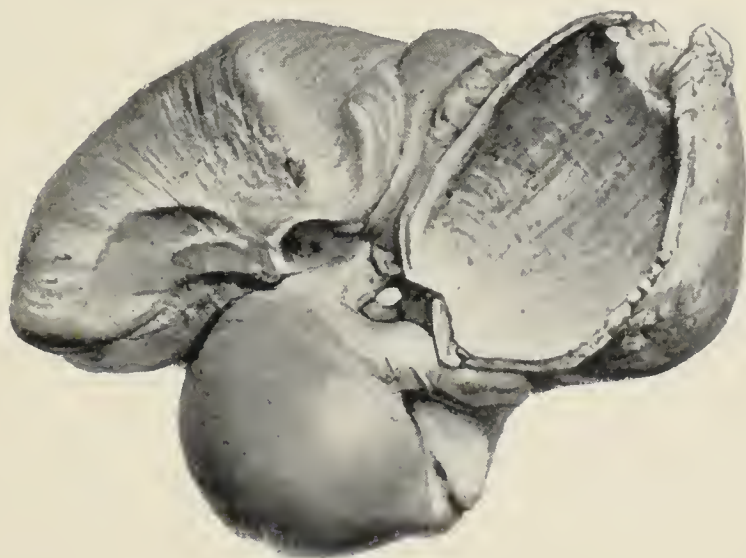
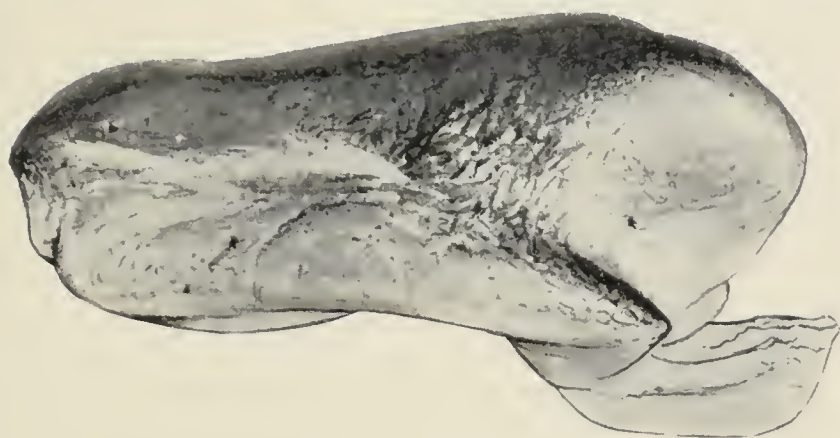
3. **Skull** of Killer Whale found in a field at Orchard farm, near Tullibody House. The skull was exposed about 20 inches from the surface and about 20 yards from an embankment which protected the field from the channel of the Forth. The skull is $20\frac{1}{4}$ inches broad; the snout is broken. Probably stranded and buried in the field.

Turner Collection.

4. **Tympano-periotic** bones, left, not articulated. Tympanic, length $2\frac{3}{4}$ inches, breadth $1\frac{1}{2}$ inch, height $1\frac{1}{4}$ inch; outer surface convex, lip-like process confined to upper border; inner surface concavo-convex, striated, gradually diminishing in height at anterior end; inferior surface bilobed; outer massive, rounded, projecting for $\frac{8}{10}$ inch; inner flattened, much smaller, projecting only $\frac{4}{10}$ inch; cleft wide, deep; inferior surface rough, ridged at inner border, outer border blends with outer surface; cavity slopes to end in a wide mouth

close to Eustachian orifice. Periotic, length $2\frac{7}{8}$ inches, breadth 2 inches, massive, stapes attached, meatus wide, articular surface for tympanic large, concave, striated. (Figures of tympanic and periotic below.)

Professor Cunningham's Collection, December 1907.

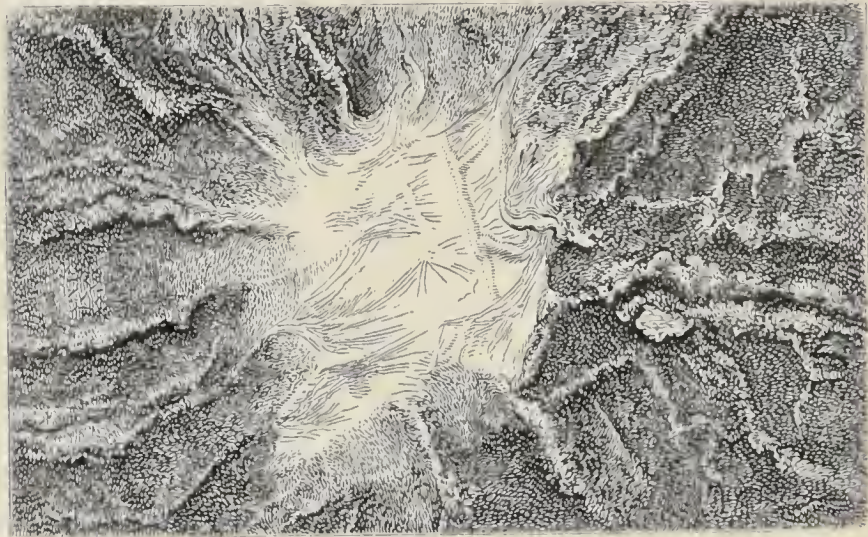


5. **Teeth**, fifteen in number, apices much worn, extracted from sockets. Cunningham Collection, 1907.
6. **Vertebræ**, block of four upper cervical, fused together: breadth of atlas 13 inches. From the specimen No. 3, found at Tullibody, 1880. Turner Collection.
7. **Heart** of Killer Whale with the great vessels connected with its chambers. The fibrous remains of the ductus arteriosus pass from the pulmonary artery to the aorta. The animal, a male, was 21 feet long; the dorsal fin was 3 feet 8 inches high; breadth of caudal fin 5 feet 10 inches. Ribs, 12 pairs. The skeleton is in the Royal Scottish Museum.
Granton, Firth of Forth, March 1876.

Turner Collection.

[Nos. 8 to 14 are from the gravid uterus the placentation of which is described by Sir Wm. Turner in *Trans. Roy. Soc. Edin.*, vol. xxvi., 1891.]

8. **Placenta.** A portion of the chorion of *Orca gladiator*, from the left uterine cornu which contained the foetus, injected red. The villi are distributed over the surface of the chorion. Amniotic corpuscles are present.
9. **Placenta.** Portion of the same chorion in which the umbilical artery was injected red; the ramifications of the vessel are seen, and the diffusion of the villi on the free surface.
10. **Placenta.** A portion of the same chorion displaying the stellate non-villous area which lies opposite the os



uteri internum. It is surrounded by vascular villi. The umbilical artery was injected with gelatine and carmine. See upper figure opposite.

The lower figure opposite shows the surface of the mucous membrane of the gravid uterus. The surface is reticulated and contains numerous crypt-like recesses in which the villi of the chorion are lodged.

11. **Placenta.** The chorion from the right uterine cornu of the same whale, injected from a branch of the umbilical artery with gelatine and Prussian blue. The villous surface is displayed. No foetus was present in this cornu, but the chorion was richly villous and vascular.
12. **Placenta.** A portion of the umbilical cord of the same, showing pigmented amniotic corpuscles.
13. **Ovary.** The pavilion of the left Fallopian tube, into which a quill has been inserted. The ovary of *Orca*, showing the large corpus luteum. The vascular plexus in the hilum of the ovary has been injected from the ovarian artery and vein.
14. **Ovary.** Another section of the corpus luteum in the same ovary, with the vessels injected, showing the vascularity of the corpus luteum.

VIII. PSEUDORCA. (Pso.)

Pseudorca, Reinhardt, *Overs. Dan. Selsk. Forh.*, 1862.

Colour black; length about 14 feet; dorsal fin about middle of back, moderate height, falcate; pectoral fin narrow, falcate; cranial and dental characters not unlike *Orca*, except that fangs of teeth are cylindrical; vertebral formula $C_7D_{10}L_9Cd_{24} = 50$. Only one species apparently, *Pseudorca crassidens* (Owen). Habitat, Danish coast, Tasmanian seas.

No specimen in Museum.

IX. GLOBICEPHALUS. (Gl.)

Globicephala, Lesson, *N. Tab. du Règne Animal*, 1842.

Globiocephalus, Gray, *Zool. Erebus and Terror*, 1846.

Globicephalus, Van Beneden and Gervais, *Ostéogr. Cétacés*.

Head rounded in front, skull elevated behind blow-hole; summit of nasals about the height of the transverse ridge on vertex; premaxillæ very broad

and markedly concave in front of nares; beak broad, flat; pterygoids large, almost meeting mesially; dorsal fin at middle of back, moderately high, with long base; pectoral limb falcate.

(1) GLOBICEPHALUS MELAS. (GL. M.)

(Pilot Whale, Ca'ing Whale, Round-headed Whale.)

Delphinus melas, *Traill, Nicholson's Journal*, xxii., 1809.

Globiocephalus svineval, *Gray, Zool. Erebus and Terror*, 1846.

Colour black, white band on ventral surface; length about 20 feet; gregarious; teeth small, conical in anterior part of jaws; V. formula $C_7D_{11}L_{11}$ to $_{14}$ Cd_{27} to $_{29} = 57$ to 60. Feeds on cuttle-fish.

1. **Skeleton**, articulated, with caudal fin. Length 10 feet 3 inches. Vertebral formula $C_7D_{10}LCd$.

Donor—Dr F. B. Archer, Barbados, 1871.

2. **Skull** of a foetus 5 feet 8 inches long; length of skull 14 inches, breadth $7\frac{1}{4}$ inches; beak $6\frac{1}{2}$ inches long, $3\frac{1}{2}$ inches broad; teeth small, acute, $\frac{10}{10} \frac{10}{10}$.

Aberdeenshire Coast, 1871.

Donor—Sir John Struthers, 1895.

3. **Skull**, adult, with mandible; length $27\frac{1}{2}$ inches, breadth $19\frac{1}{2}$ inches; beak, length of, 15 inches, breadth 11 inches; teeth absent. Premaxilla broadest at the middle, 4 inches, not completely covering superior maxilla; prenasal surface markedly concave, mid surface convex; ossification of mesethmoid extending 5 inches between premaxillæ. Monro Collection.

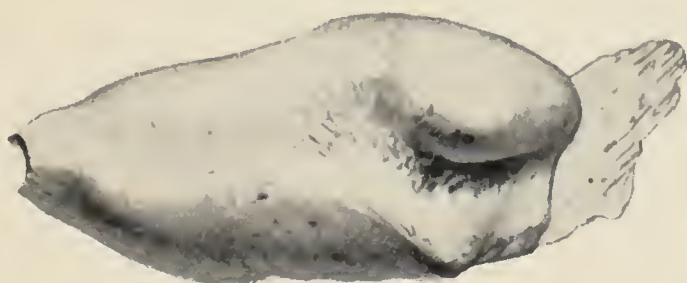
4. **Skull**, without mandible; length 27 inches, breadth $19\frac{1}{2}$ inches; beak 15 inches long, breadth 11 inches; teeth in anterior part of jaw, small, acute, $\frac{9}{-} \frac{9}{-}$. Premaxilla as in No. 3.

Granton, Firth of Forth.

Donor—Sir John Murray, K.C.B.

5. **Skull**, adult, without mandible; length $25\frac{1}{4}$ inches, breadth $17\frac{3}{4}$ inches; beak, length $14\frac{1}{2}$ inches, breadth $10\frac{1}{4}$ inches; teeth absent. Premaxilla broadest at the middle ($3\frac{1}{4}$ inches), not completely covering superior maxilla; prenasal surface concave, mid surface convex; ossification of mesethmoid extending for 5 inches between premaxillæ.

6. **Skull**, without mandible; length $23\frac{1}{2}$ inches, breadth $16\frac{1}{4}$ inches; beak, length 13 inches, breadth $8\frac{3}{4}$ inches; teeth absent. Premaxillæ as in No. 3.
7. **Skull**, without mandible, probably female; length 24 inches, breadth $15\frac{1}{2}$ inches; beak 13 inches long, breadth $9\frac{1}{4}$ inches; teeth absent; premaxillæ smaller than in No. 3, but similarly formed. Pterygoids separated by a cleft $\frac{1}{4}$ inch wide.
8. **Skull**, bisected, right half of.
9. **Skull**, disarticulated, with mandible, one of a school which visited the Firth of Forth, captured at Granton in 1867. The specimen, a young female, about 8 feet long, was dissected by Turner, *Journ. Anat. and Phys.*, vol. ii., 1868. See Nos. 18, 22, 24 to 32.
10. **Skull** of foetus, disarticulated, from a "Black Fish" (*Globiceps*), from the Gulf of Mexico.
Donor—Dr F. B. Archer.
- 10A. **Cranium**, rostrum wanting, of a foetal *G. melas*; ossification incomplete. The frontal and interparietal form the vertex cranii in the region between the nasals and the occipital. The supra-occipital is not fused with the exoccipitals, nor is the basi-occipital with the basisphenoid.
11. **Mandible** of *G. melas*, fused at the symphysis; length $17\frac{1}{2}$ inches, of symphysis $1\frac{7}{8}$ inch; teeth moderate, acute, $\overline{9} \overline{9}$.
Speight's Town, Barbados, May 1869.
Donor—Dr Archer.
12. **Teeth** of *G. melas*, extracted from the jaws of a young animal; crowns acute and small.
Barbados, 1869.
Donor—Dr Archer.
13. **Tympano-periotic** bones, right, not fused. Tympanic, length $1\frac{7}{8}$ inch, breadth $\frac{3}{4}$ inch. Bilobed; right lobe prominent, rounded, large; left small, pointed; cleft

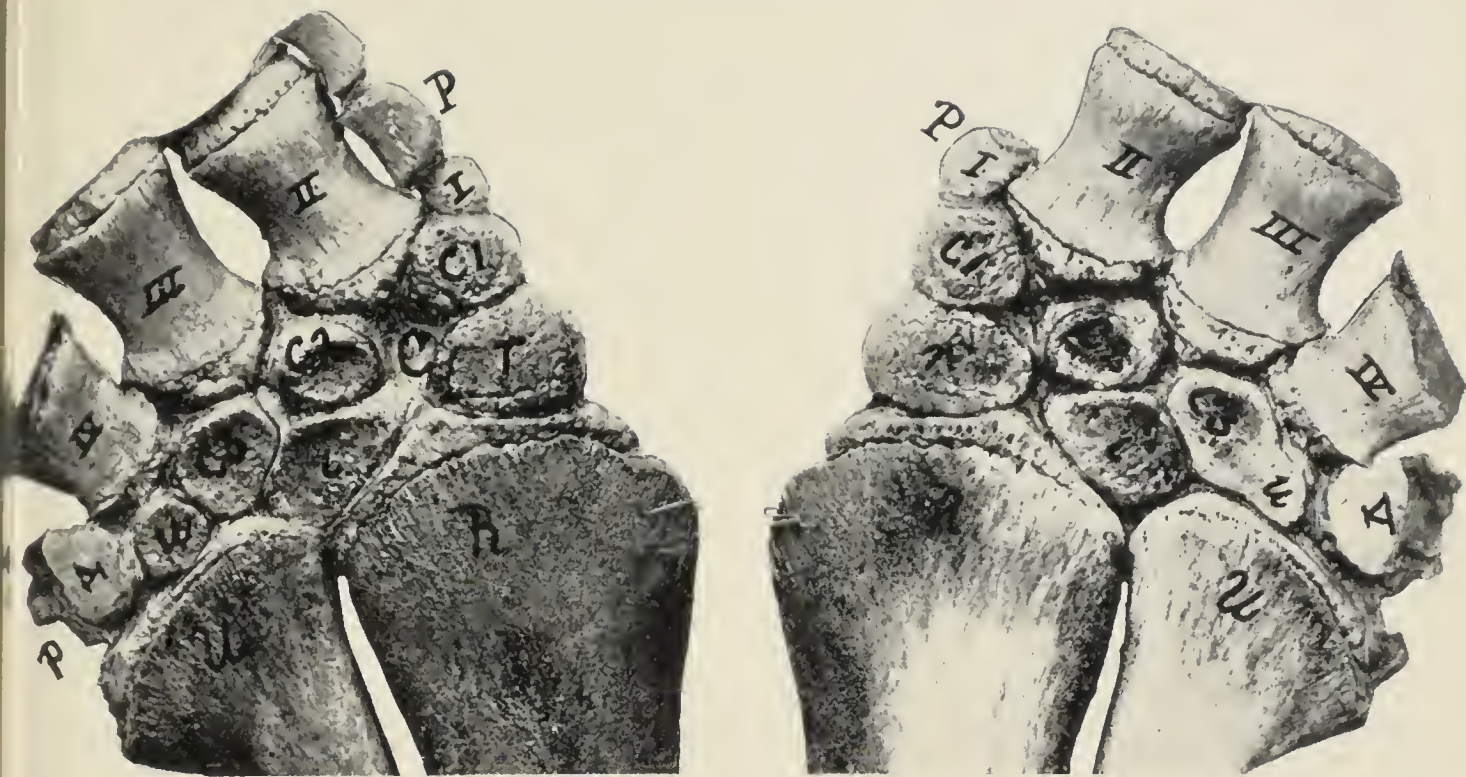


deep; inferior surface narrow, bounded on inner side by ridge, externally it blends with outer surface; anterior end somewhat pointed, bounds the wide mouth of the cavity. (Figure, p. 115.) Periotic, length $1\frac{3}{4}$ inch, breadth 1 inch, meatus wide, anterior surface for tympanic deeply striated, pointed posteriorly.

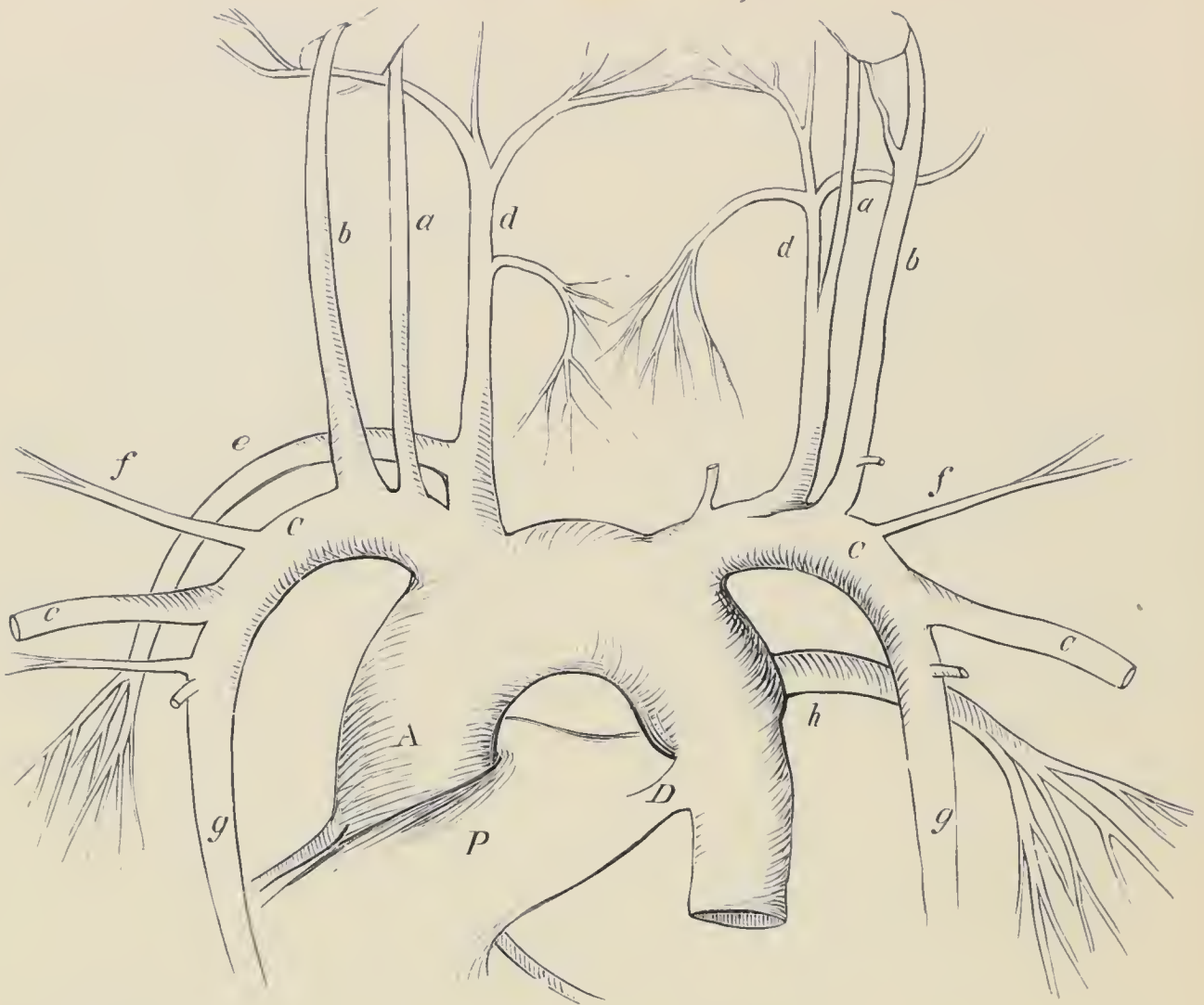
Klagsvig, Faroe Islands.

Donor—Dr Nelson Annandale.

14. **Tympano-periotic** bones, left, of foetus, fused, from No. 2. Tympanic $1\frac{3}{4}$ inch long, 1 inch broad. Periotic $1\frac{1}{2}$ inch long, 1 inch broad.
15. **Tympano-periotic** bones, right, articulated, of *G. melas*. Tympanic, length $1\frac{5}{8}$ inch, breadth $\frac{7}{8}$ inch, height $\frac{3}{4}$ inch. Periotic, length $1\frac{7}{8}$ inch, breadth $1\frac{1}{8}$ inch.
16. **Sternum** of adult *G. melas*, upper two segments, each of which had a mesial foramen. Goodsir Collection.
17. **Sternum**, from a foetal *G. melas*, No. 2, with three distinct bony segments, the manubrium being almost completely divided into two lateral halves; five pairs of ossified costal cartilages articulate with sternum and the xiphi-sternal cartilage. The right 6th apparently does not reach it. Donor—Sir John Struthers, 1895.
18. **Hyoid** bone, dried specimen, from the foetus of *G. melas*, No. 2, complete with stylo-hyoids. Donor—Sir John Struthers, 1895.
19. **Vertebræ**, cervical, and upper three dorsal vertebræ bisected, left half. The upper three left ribs are articulated to their vertebræ. Atlas and axis partially fused, other vertebræ distinct. From the young female of the school captured at Granton, 1867. The skull is No. 9, and a number of the other bones of the skeleton remain disarticulated.
20. **Caudal** Fin, dried, showing the mesial notch, from a Black Fish (*Globicephalus*). Barbados. Donor—Dr F. B. Archer.
21. **Pectoral** Limbs, pair of, articulated, bones of. The manus is described and figured by Turner in *Proc. Roy. Soc. Edin.*, vol. xxix., 1909. Right manus contains radiale, intermedium, ulnare, distal carpalia C_1, C_2, C_3 , and a centrale; the left has no centrale; each has a pisiform cartilage; the digits have MPh_2 , pollex, MPh_{12} , MPh_8 , MPh_2 , MPh_1 . See figure, page 117. Goodsir Collection.



22. **Pectoral** Limbs, pair of adult, articulated. The manus contains the proximal carpalia, radiale, intermedium, ulnare, and the distal carpalia C_1 , C_{2+3} , C_4 . The phalangeal formula is: pollex, MPh_2 ; index, MPh_{10} ; medius, MPh_8 ; annulus, MPh_2 ; minimus, MPh_1 .
Turner Collection.
23. **Pectoral** Limb, cast of right, of No. 20.
Goodsir Collection.
24. **Pectoral** Limbs, articulated, skeleton of pair of foetal, apparently of *G. melas*.
25. **Stomach** of adult Pilot Whale, inflated and dried. The oesophageal compartment or paunch is 2 feet 7 inches long; the cardiac or 2nd compartment, sub-globular in shape, is 14 by $9\frac{1}{2}$ inches: the 3rd and 4th intermediate compartments are small, the 3rd seemed as if only a tubular passage: the 4th is globular, 5 by $4\frac{1}{2}$ inches: the 5th tubular or pyloric compartment is 17 inches long, and communicates with the dilated duodenum. The stomach of No. 9, a young animal, is described and figured in *Journ. Anat. and Phys.*, vol. ii., 1868.
26. **Heart** and great arteries of *G. melas*, dried specimen. Described and figured by Turner in *Journ. Anat. and Phys.*, vol. ii., 1868. See figure of great vessels on page 118.



A, aorta; P, pulmonary artery; D, ductus arteriosus; *a*, carotis cerebialis; *b*, carotis facialis; *c*, subclavica; *d*, cervico-occipitalis; *e*, thoracica posterior dextra; *f*, transversalis colli; *g*, mammaria interna; *h*, thoracic posterior sinistra.

[Nos. 27 to 35 are from the young specimen, No. 9.
See Turner in *Journ. Anat. and Phys.*, vol. ii.,
1868.]

27. **Lymphatic** chyle-filled vessels in the mesentery of *G. melas*. The branches of the mesenteric artery have been injected red.
28. **Lymphatics**. A similar preparation.
29. **Lymphatic** gland from the root of the mesentery of the same animal, showing the chyle-filled vessels entering the hilum.
30. **Lymphatics** filled with chyle in the mesentery of the same specimen. Both mesenteric arteries and veins have been injected.
31. **Spleen** of *G. melas*, showing its multilobulated character, minutely injected.

32. **Kidney**, longitudinal section; renal artery injected red, renal vein blue. The ureter with a part of the calyx is exposed.
33. **Kidney**. Another portion of the same kidney.
34. **Kidney**. Section through opposite kidney. Artery injected red, ureter and calyces blue.
35. **Kidney**. Another portion of the same kidney.
36. **Brain** of *G. melas*, from one of the school taken at Granton in 1867, obtained by Dr James Struthers of Leith, and presented by Sir John Struthers in 1895.
37. **Brain**, from another specimen of the same school, along with a portion of the spinal cord. Also presented by Sir John Struthers.
38. **Brain**. The specimen is figured in Professor Calderwood's *Mind and Brain*, p. 181, 1879.
39. **Uterus**, two-horned, and **vagina**. Cervix and vagina opened to show the folds of mucous membrane. On the opposite aspect the pyriform bladder has been opened into, and the ureters and urethra have had quills passed into their orifices. Turner Collection.

(2) GLOBICEPHALUS MACRORHYNCHUS. (GL. MAC.)

Globiocephalus macrorhynchus, Gray, *Zool. Erebus and Terror*, p. 33, 1846.

Globiocephalus macrorhynchus, Hector, *Trans. Welling. Phil. Soc.*, Sept. 1869.

Described by Dr J. G. Gray as the Large-headed Pilot Whale, *G. macrorhynchus*, from a specimen in the Museum, Royal College of Surgeons, London, and localised as inhabiting the South Seas. Sir James Hector adopts the specific name and calls it the "Black Fish of the South Seas." Flower, in his *Catalogue of Cetacea*, states that the British Museum contains a stuffed specimen with its skull, from the Cape of Good Hope. The skull, he says, is distinguished from *G. melas* by the premaxilla in the anterior half of the rostrum completely covering the superior maxilla. In the following specimens, presented by Sir J. Hector to the University Museum in 1872, the premaxilla does not in this respect differ materially from *G. melas*. It is doubtful if this species should be continued.

1. **Skeleton**, articulated, with pelvic bones and hyoid; length 14 feet 1 inch; vertebral formula $C_7D_{11}L_{14}Cd_{25}=57$. Premaxilla definitely concave in front of nares, broad on rostrum but not obscuring superior maxilla.
New Zealand, 1878.
2. **Skull**, without mandible, $25\frac{1}{4}$ inches long, 18 inches broad; beak 14 inches long, 10 inches broad; teeth absent, but ten sockets on each side. Premaxillæ broadest at the foramen, $3\frac{1}{8}$ inches, not completely covering superior maxillæ; prenasal surface concave, mid surface convex; ossification of mesethmoid extending $5\frac{1}{4}$ inches between premaxillæ. Pterygoids broken.
New Zealand.
3. **Skull**, aged, with mandible, 24 inches long, $15\frac{3}{4}$ inches broad; beak 13 inches long, $8\frac{1}{2}$ inches broad; teeth absent, with ten sockets in lower jaw. Premaxillæ with greatest width, $2\frac{7}{8}$ inches, at middle; in other respects as in No. 2. Pterygoids separated by narrow fissure. Mandible $19\frac{1}{4}$ inches long, symphysis $2\frac{1}{4}$ inches.
Chatham Islands.
4. **Tympano-periotic** bones, right; stapes present, but not fused. Tympanic $1\frac{3}{4}$ inch, breadth $\frac{3}{4}$ inch; periotic, length $1\frac{1}{2}$ inch. Characters resemble *G. melas*.
New Zealand.
5. **Mandible**, detached, with $\overline{7} \overline{7}$ teeth at anterior end, crowns acute; probably *G. macrorhynchus*.
6. **Mandible**. Length $19\frac{3}{4}$ inches, greatest height $6\frac{1}{4}$ inches; symphysis $2\frac{1}{8}$ inches. Teeth, 10 on each side of the anterior end of the mandible, moderate in size, conical.
New Zealand. Sir James Hector.

X. GRAMPUS. (Gr.)

Grampus, *Gray, Zool. Erebus and Terror*, p. 30, 1846.

Colour variable, slaty grey, mottled, irregularly streaked. No teeth in upper jaw, a few in mandible at symphysial end. Head globose, no beak; dorsal fin falcate, high; pectoral limb narrow, falcate.

(1) GRAMPUS GRISEUS. (Gr. G.)

(Risso's Dolphin.)

Delphinus griseus, *G. Cuvier, Ann. Mus.*, xix., 1812.Grampus griseus, *Gray, Spicil. Zoologica*, 1828.Delphinus rissoanus, *Gray, Zool. Erebus and Terror*, 1846.

Apparently the only species; may reach 13 feet in length. Skull massive; beak wide at base, obtuse at apex, one-half length of skull; premaxilla somewhat convex; pterygoids prominent, in contact in the median line. The Museum contains two skeletons and three separate skulls from a school of nine, six of which were captured off Hillswick, Shetland, in September 1889. The specimens were obtained through Dr Charles Anderson of Hillswick. They varied in length from 8 feet 7 inches to 10 feet 5 inches. In the mandibular dentition, two skulls

were $\frac{0}{4} \frac{0}{4}$, four were $\frac{0}{3} \frac{0}{3}$. See Sir Wm. Turner in *Proc.*

Roy. Phys. Soc. Edin., vol. xi., 1892.

1. **Skeleton**, male, articulated, with dorsal and caudal fins and pelvic bones; length 9 feet 10 inches. Vertebral formula $C_7D_{12}LCd_{49}=68$. This and the other specimens of Risso's Dolphin were in the Turner Collection.

Shetland, 1889.

2. **Skeleton**, female, articulated, with dorsal and caudal fins, pelvic bones and hyoid; length 9 feet 9 inches. Vertebral formula $C_7D_{12}LCd$.

Shetland, 1889.

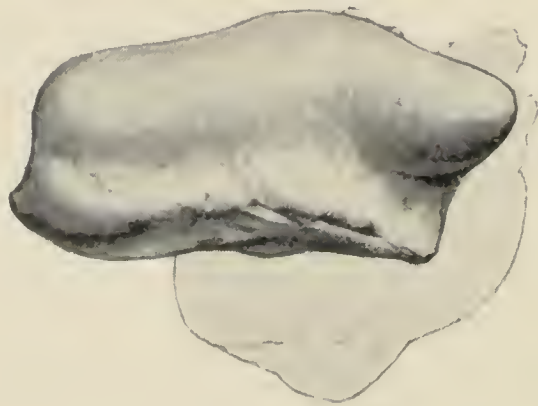
3. **Skull**, with mandible; length $19\frac{3}{4}$ inches, breadth 13 inches; length of beak from maxillary notch $10\frac{1}{4}$ inches, breadth at base $7\frac{1}{4}$ inches; nasals a little higher than ridge of vertex cranii; premaxilla convex in front of nares, its width being $2\frac{5}{8}$ inches, not quite concealing superior maxilla at end of rostrum: teeth

acute, moderate, $\frac{0}{3} \frac{0}{3}$; pterygoids large, almost in contact mesially. Mandible $15\frac{1}{2}$ inches long, symphysis $2\frac{1}{4}$ inches.

Shetland.

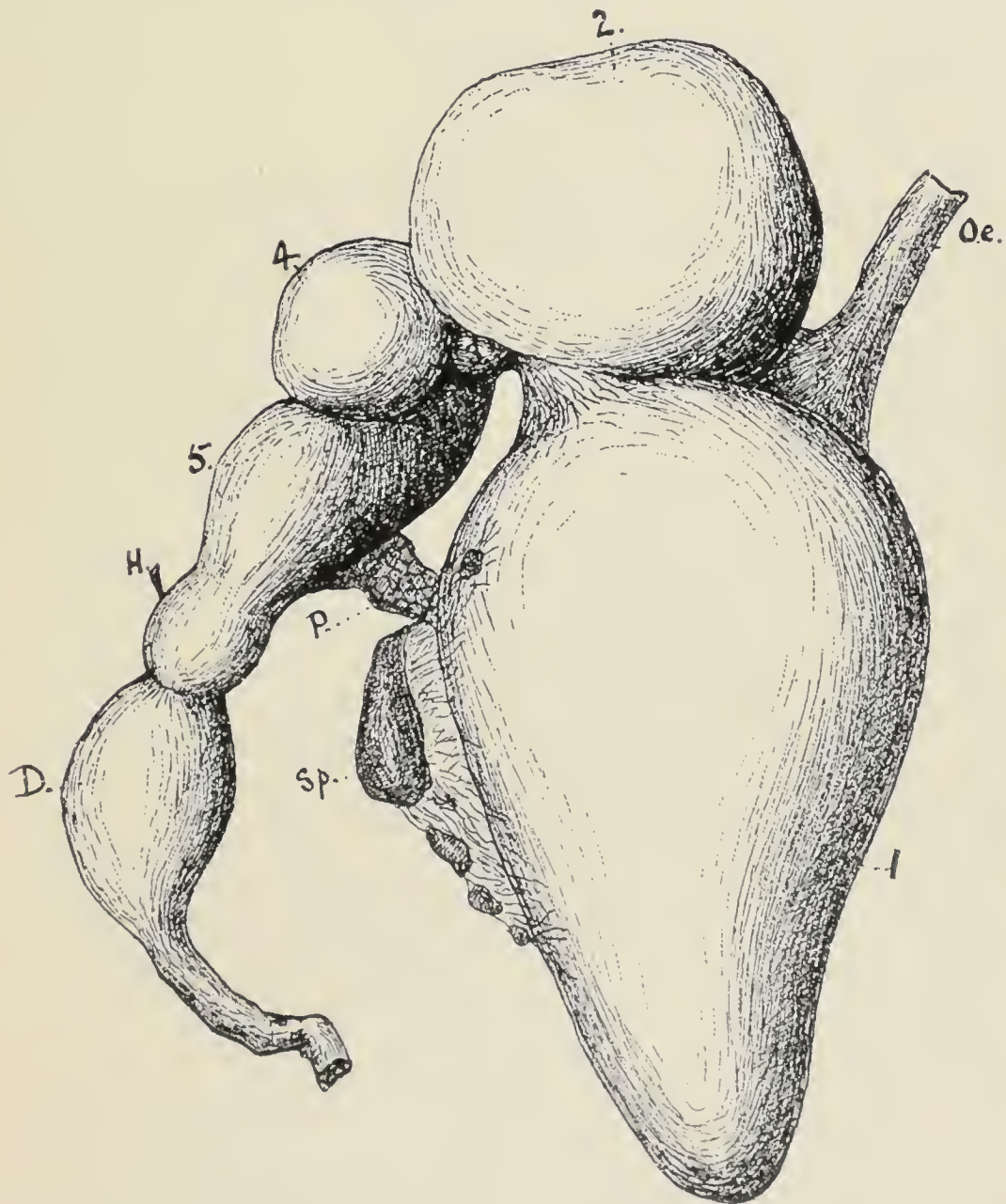
4. **Skull**, with mandible; length 19 inches, breadth $12\frac{3}{4}$ inches; length of beak from maxillary notch $9\frac{3}{4}$ inches, breadth at base 7 inches; characters as in

- No. 3. Teeth $\frac{0}{4} \frac{0}{4}$. Mandible, length of, $15\frac{1}{4}$ inches, symphysis $1\frac{3}{4}$ inch. Shetland.
5. **Skull**, with mandible; length 19 inches, breadth $12\frac{1}{2}$ inches. Length of beak from maxillary notch 10 inches; breadth at base $7\frac{1}{4}$ inches; characters resemble No. 3. Teeth $\frac{0}{3} \frac{0}{3}$. Mandible $15\frac{1}{4}$ inches, symphysis $2\frac{3}{8}$ inches. Shetland.
6. **Tympano-periotic** bones, pair of, fused (A and B). Tympanic length $1\frac{5}{8}$ inch, breadth $\frac{3}{4}$ inch, height $\frac{5}{8}$ inch; outer surface with two convexities separated by a shallow depression, the posterior being longer than the anterior; lip-like process very short on outer surface. Inner surface $\frac{1}{2}$ inch in height for three-quarters of length, then rapidly sloping to Eustachian orifice. Bilobed; outer lobe smooth, rounded, prominent; inner small, flattened, pointed, cleft deep; inner lobe continuous with ridge bounding inferior surface internally, whilst externally this surface blends with outer surface; cavity opens by wide mouth close to anterior end of inferior surface. Periotic length $1\frac{1}{2}$ inch, breadth $\frac{3}{4}$ inch; meatus large; tympanic surface of articulation concave, deeply striated. The series of bones, A to L, were from the six Shetland skulls: ossicles present. Tympanic figured below.



7. **Tympano-periotic** bones, pair of, fused (C and D). Tympanic length $1\frac{5}{8}$ inch, breadth $\frac{7}{8}$ inch; periotic length $1\frac{5}{8}$ inch.
8. **Tympano-periotic** bones, articulated (E and F). Tympanic length $1\frac{3}{4}$ inch, breadth $\frac{3}{4}$ inch; periotic length $1\frac{1}{2}$ inch; tympanic ossicles present.

9. **Tympano-periotic** bones, pair of, articulated (G and H). Tympanic length $1\frac{5}{8}$ inch, breadth $\frac{3}{4}$ inch; periotic length $1\frac{1}{2}$ inch; stapes attached.
10. **Tympano-periotic** bones, right, and the left periotic (I and K). Tympanic length $1\frac{3}{4}$ inch, breadth $\frac{3}{4}$ inch; periotic length $1\frac{1}{2}$ inch.
11. **Tympano-periotic** bones, right, fused (L). Tympanic length $1\frac{5}{8}$ inch, breadth $\frac{3}{4}$ inch; periotic length $1\frac{1}{2}$ inch.
12. **Stomach** of Risso's Dolphin, inflated and dried. It consists of five compartments: a large œsophageal paunch 2 feet long; a globular cardiac compartment 10 by



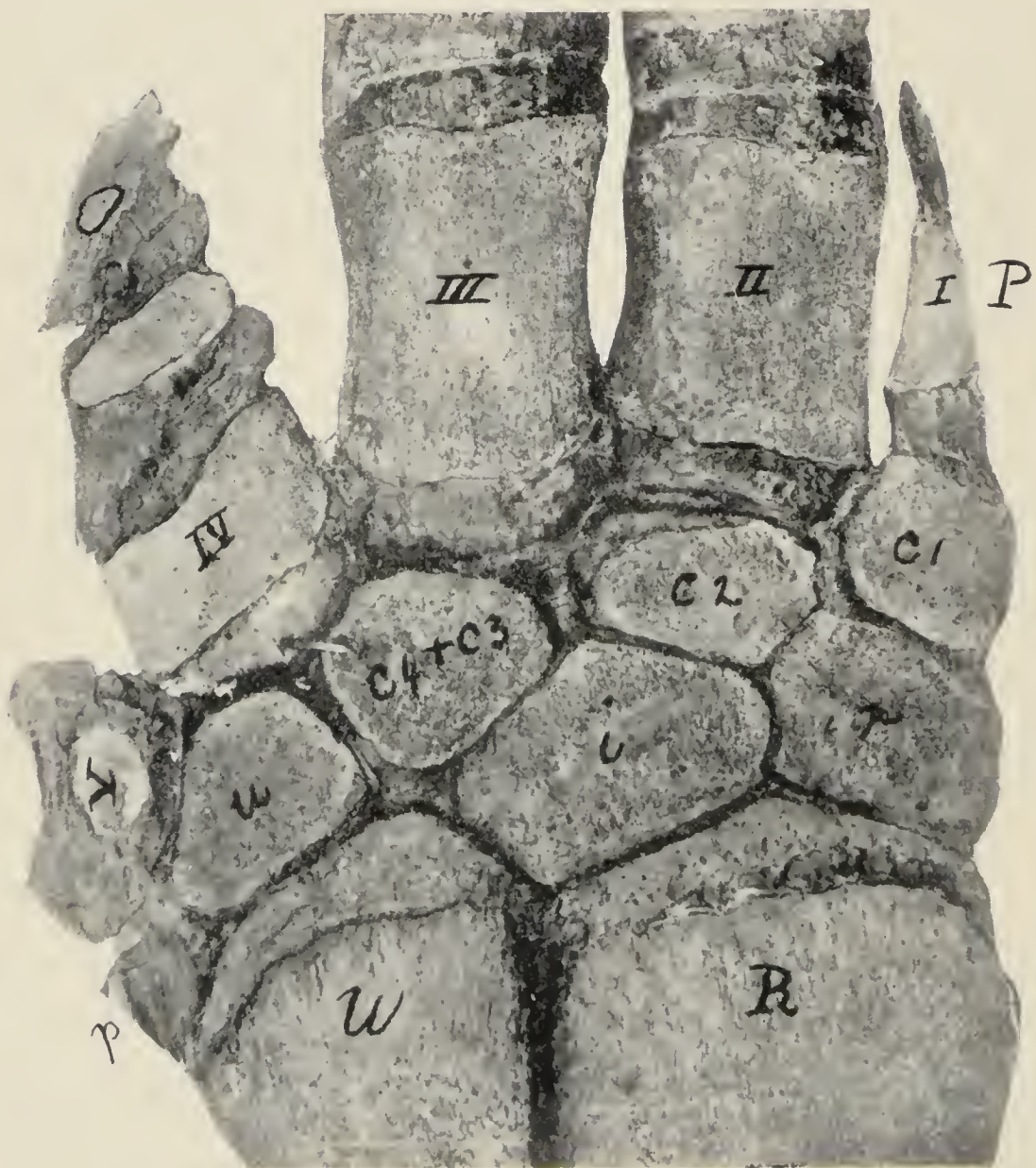
œ, œsophagus; 1 to 5, compartments of stomach; D, duodenum; H, hepatic duct; P, pancreas; Sp, spleen.

9 inches; two intermediate compartments, of which the one next the cardiac is very small; a tubular pyloric compartment 12 inches long which opens into the dilated commencement of the duodenum. See Turner in *J. A. and P.*, vol. xxvi., 1892. Figure, page 123.

13. **Stomach.** Remains of Cuttle-fish, *Gonatus fabricii* (Lichtenstein), from the stomach of Risso's Grampus.

14. **Heart and Great Vessels.** See Addenda.

15. **Manus**, figure of, dorsal surface of left. U, ulna; R, radius; r, radiale; i, intermedium; u, ulnare; p, pisiform cartilage; C₁ and C₂, distal carpals 1 and 2; C₃+C₄, conjoined carpalia; I to V, metacarpals of five digits. P, pollex. Fifth digit rudimentary. Manus described by Turner in *Pr. R. S. Edin.*, vol. xxix., 1909.



XI. LAGENORHYNCHUS. (Lrh.)

Lagenorhynchus, *Gray, Zool. Erebus and Terror*, p. 34, 1846.

Dr Gray gives the characters which distinguish this genus from *Delphinus* as follows: forehead low; beak short, depressed; dorsal fin further back, body attenuated behind; end of skull broad, flat, expanded.

(1) LAGENORHYNCHUS ALBIROSTRIS. (LRH. AL.)

(White-beaked Dolphin.)

Delphinus albirostris, *Gray, Ann. Mag. Nat. Hist.*, 1846.

Lagenorhynchus albirostris, *Gray, Zool. Erebus and Terror*.



Colour, top of head and back black; venter white, mottled grey, sides dark grey; tip of short beak, upper lip, and skin of mandible white; tip of beak differentiated by a groove. Length 8 to 10 feet. Dorsal fin black, falcate, high; pectoral limb black, short, falcate; pterygoids short, broad, meeting mesially. Vertebral formula C_7D_{15} or $_{16}L_{23}$ or $_{24}Cd_{43}$ to $_{45}$ = 88 to 92. Teeth numerous, acute. Beak half length of skull.

1. **Skeleton**, female, articulated, with dorsal and caudal fins, pelvic bones and hyoid. Length 7 feet 10 inches: vertebral formula $C_7D_{15}LCd$. Length of animal about $8\frac{1}{2}$ feet. Accompanied by a calf 3 feet 11 inches long. See Turner in *Proc. Roy. Phys. Soc. Edin.*, 1889, vol. x.

Stonehaven, July 1888.

Turner Collection.

2. **Skull**, adult, with broken mandible; length $17\frac{1}{2}$ inches, breadth $9\frac{3}{4}$ inches. Length of beak $8\frac{3}{4}$ inches, breadth

at base 5 inches. Summit of nasals, ridge and suture on vertex almost on same plane; premaxillæ convex and tumid in front of nares, grooved for some distance beyond the foramen, then again slightly convex. Superior maxillæ form borders of beak.

Teeth moderate, acute, $\frac{26}{24} \frac{26}{24}$. Pterygoids large, slightly in contact mesially.

Kilbrennan Sound, September 1879.

Donor—J. Y. Buchanan, Esq., F.R.S.

3. **Skull**, adult, with mandible; length 18 inches, breadth 10 inches. Length of beak 9 inches, breadth at base 5 inches. Teeth moderate, acute, $\frac{24}{24} \frac{24}{24}$. Mandible length $14\frac{3}{4}$ inches, symphysis $1\frac{5}{8}$ inch.

Berwick, July 1881.

Donor—Mr Brotherston.

Turner Collection.

4. **Skull**, adult female, with mandible; length 17 inches, breadth $9\frac{1}{2}$ inches. Length of beak $8\frac{1}{2}$ inches, breadth at base $5\frac{1}{4}$ inches. Teeth sockets $\frac{24}{26} \frac{24}{26}$. Mandible $14\frac{1}{4}$ inches long, symphysis $1\frac{3}{4}$ inch. The animal was gravid, and was found beached on the sands at Kintradwell, Sutherland, May 1882.

Donor—Rev. Dr Joass, Golspie. Turner Collection.

5. **Skull**, adult, without mandible; length $18\frac{1}{2}$ inches, breadth 10 inches. Length of beak 9 inches, breadth at base $5\frac{1}{2}$ inches. Tooth sockets $\frac{26}{26} \frac{26}{26}$.

St Ninian's Bay, Bute, November 1899.

Donor—H. B. Watt, Esq.

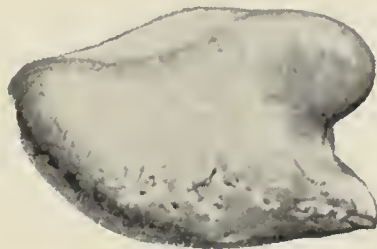
6. **Skull**, with mandible, from a young female *L. albirostris*. Length of skull 12 inches, breadth $5\frac{3}{4}$ inches. Length of beak $5\frac{1}{2}$ inches, breadth $3\frac{1}{4}$ inches. Teeth moderate, acute, $\frac{24}{26} \frac{24}{26}$. Length of mandible $9\frac{1}{2}$ inches, of symphysis $1\frac{1}{8}$ inch. Length of animal 4 feet 2 inches. Right tympano-periotics *in situ*. Described by Professor Cunningham, F.R.S., in *Proc. Zool. Soc. Lond.*, June 1876.

Great Grimsby, September 1875.

Professor Cunningham's Collection.

7. **Tympano-periotic** bones, left, fused, also with temporal, from the young skull, No. 6. Tympanic length $1\frac{1}{4}$

inches, breadth $\frac{7}{8}$ inch, height $\frac{5}{8}$ inch; outer surface flattened behind, slightly convex in front, lip-like process relatively large and prolonged slightly on outer surface; inner surface convex, and its upper border inclines rapidly to Eustachian opening; bilobed behind, outer smooth, larger, rounded; inner smaller, laterally compressed, pointed; cleft deep, wide, short; inferior surface smooth, broad, slightly concave; lateral borders faintly marked, not ridged; cavity opens by narrow mouth at anterior end of inferior surface. (Figure below.) Periotic length $1\frac{1}{8}$ inch, breadth $\frac{3}{4}$ inch; meatus large. Cunningham Collection.



8. **Tympanic** bone, right, of *L. albirostris* from No. 4, the skull presented by the Rev. Dr Joass. Length $1\frac{1}{2}$ inch, breadth $\frac{7}{8}$ inch, height $\frac{3}{4}$ inch.
9. **Vertebræ**, seven cervical; atlas and axis fused; from young *L. albirostris*, No. 6. Cunningham Collection.
10. **Stomach** of adult White-beaked Dolphin, inflated and dried. The œsophageal compartment or paunch is 19 inches long; the cardiac or 2nd compartment is subglobular in form; the 3rd or intermediate compartment has the size of a small pear and opens into the 4th or pyloric compartment, 12 inches long, tubular in shape, which opens into the funnel-shaped duodenum. From No. 1. See Turner in *Journ. Anat. and Phys.*, vol. xxiii., 1889.
Stonehaven, July 1888.
11. **Stomach** of calf of White-beaked Dolphin, inflated and dried. The compartments correspond in number and arrangement with the adult, but are necessarily much less in their dimensions. Turner Collection.
12. **Hair**. Beak of young *L. albirostris*, showing the white integument of the upper lip with several delicate hairs and the mouths of follicles from which hairs had at one time extruded. A V-shaped furrow marks off the lip from the front of the head. See Turner in *Proc. Roy. Phys. Soc.*, vol. x., 1881-89.

13. **Manus**, dorsal surface of left (figure below.) R, radius; U, ulna; r , radiale; i , intermedium; u , ulnare; $C_2 + C_3$, second and third distal carpalia; C_4 , fourth distal carpal. I to V, the five digits; P, pollex. See Turner in *Proc. Roy. Soc. Edin.*, vol. xxix., 1909, for description.



(2) *LAGENORHYNCHUS ACUTUS*. (LRH. AC.)

(White-sided Dolphin.)

Delphinus acutus, Gray, *Spic. Zool.*, vol. i., 1828.

Delphinus leucopleurus, Rasch, *Nova Spec. Descript.*, 1843.

Leucopleurus arcticus, Gray, *Synops. Whales and Dolphins*, 1868.

Colour, top of head, back, and adjoining sides, dorsal fin, pectoral limbs, dorsum of tail, black; light yellowish-brown and white band on side of body; venter white and greyish-white. Length 6 to $8\frac{1}{2}$ feet. Beak pointed, half length of skull, its breadth at base about half the length of beak; dorsal fin high, falcate; pectoral limb short, tip pointed: pterygoids meeting mesially. Vertebral formula $C_7D_{15}LCd_{58} = 80$. Teeth numerous, acute. See Plate XV.

1. **Skeleton**, female, articulated, with dorsal and caudal fins, pelvic bones, and hyoid. Length of animal 6 feet. Length of skeleton 5 feet 9 inches. Vertebral



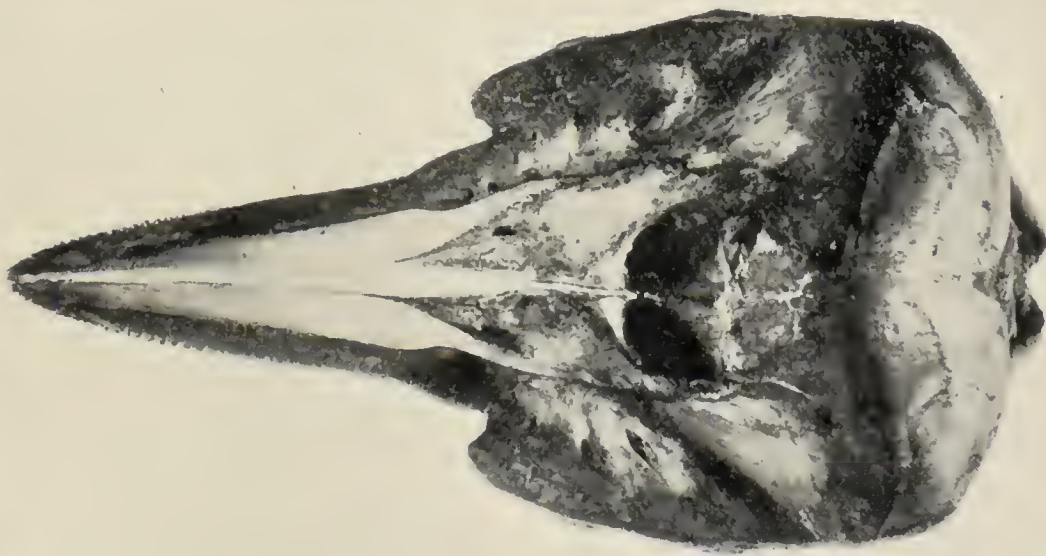
Lagenorhynchus acutus.

formula $C_7D_{15}LCd_{58}=80$. Teeth small, acute, $\frac{36}{37} \frac{36}{37}$.

Length of skull 15 inches, breadth of skull 7.6 inches; length of beak 7.5 inches, breadth at base of beak 3.8 inches. Length of mandible 12 inches, of symphysis $1\frac{1}{2}$ inch. Premaxillæ at first flattened then concave in front of nares, almost flat in the beak itself. Superior maxilla distinct on each side of premaxilla. Nasals thickened at summit and on same plane as vertex cranii. Pterygoids relatively large, meeting mesially. Palate bone narrow in front of pterygoid; vomer distinct in middle and anterior part of hard palate; no lateral longitudinal groove on palate. Described by Sir Wm. Turner in *Proc. Roy. Soc. Edin.*, vol. xxvi., 1906. See figure below.

Coast of Sutherland.

Donor—The Duke of Sutherland, through the Rev. Dr Joass, Golspie.

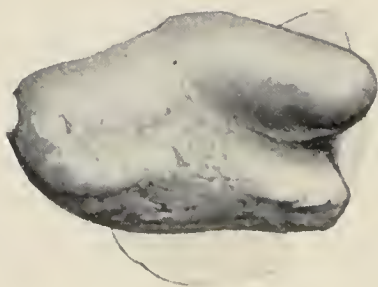


2. **Skull**, with mandible, top imperfect, not adult. Length 15 inches, breadth 8 inches; beak, length $7\frac{3}{4}$ inches, breadth at base $3\frac{3}{4}$ inches. Premaxillæ flattened in front of nares, then slightly concave, and further forward slightly convex. Pterygoids relatively large, meeting mesially. The characters closely correspond with the skull of No. 1, so that it is regarded as *L. acutus*. Mandible, length $12\frac{1}{4}$ inches, height $2\frac{1}{2}$ inches; symphysis, length $1\frac{1}{2}$ inch. Teeth small, acute, $\frac{29}{31} \frac{29}{31}$. Left tympano-periotic *in situ*. No

history is attached to the specimen, but it may have been in the Knox Collection.

3. **Skull**, with mandible broken. Length of skull $13\frac{1}{2}$ inches, breadth $7\frac{1}{2}$ inches; beak 7 inches long, 4 inches broad at base; nasals and frontal in same plane; premaxillæ in front of nares a little concave, then flattened and slightly convex towards pointed tip; pterygoids moderate, meeting mesially. Teeth small, acute, $\frac{25}{26}$ $\frac{25}{26}$. Symphysis, length $1\frac{1}{2}$ inch. Purchased 1879.

4. **Tympano-periotic** bones, articulated left; tympanic $1\frac{1}{4}$ inch long, $\frac{3}{4}$ inch broad, height $\frac{1}{2}$ inch; outer surface convex anteriorly, flattened posteriorly, lip-like process with the groove in front scarcely marked on this surface; inner surface $\frac{1}{4}$ inch in height, rapidly sloping to Eustachian orifice; bilobed, outer lobe the larger, smooth, rounded, inner laterally compressed; cleft deep, short, inferior surface broad, almost flat; inner border marked by ridge, outer not so distinct and blends with outer surface; cavity opens by moderate mouth close to anterior end of inferior surface. See figure below. Periotic $1\frac{1}{8}$ inch long, $\frac{3}{4}$ inch broad; meatus wide; right bone retained in skull. From No. 1. Donor—Rev. Dr Joass, Golspie.



5. **Pectoral Limb** of No. 1, radiograph of, showing the bones and the centres of ossification, *v*, 5th digit.



XII. DELPHINUS. (D.)

(The True Dolphins.)

Delphinus, *Linnaeus, Syst. Nat.*, 1776.

Beak long and marked out by V-shaped groove.
Teeth numerous in both jaws; palate ridged mesially,
deep groove on each side; pterygoids meeting
mesially; dorsal fin moderate, falcate.

(1) DELPHINUS DELPHIS. (D. D.)

(Common Dolphin.)

Delphinus delphis, *Linnaeus, supra cit.*

Colour black on top of head, back, dorsal fin, tail:
yellowish grey on pectoral limb, belly white, grey-
tinted fawn colour high on side of body, lighter
band from angle of mouth almost to tail. Length
7 to 8 feet; dorsal fin narrow. Beak more than half
the length of skull. Form graceful.

1. **Skeleton**, female, articulated, immature, with dorsal and caudal fins, pelvic bones and hyoid. Length of animal 5 feet 5½ inches; length of skeleton 5 feet 1 inch. Vertebral formula $C_7D_{14}LCd_{54}=75$. Plates not ossified to vertebræ. See Turner's description in the *Proc. Roy. Phys. Soc. Edin.*, 1887. Teeth numerous.

Dalmeny, Firth of Forth, February 1887.

[No. 1 and the succeeding specimens of *D. delphis* are from the Turner Collection.]

2. **Skeleton**, male, articulated, with dorsal and caudal fins, pelvic bones and hyoid; plates not ossified to vertebral bodies. Length of skeleton 5 feet 9 inches; length of skull 16¾ inches. Nasals on same plane as vertex

cranii; premaxillæ concave in front of nares, then convex almost as far as pointed tip. Teeth $\frac{50}{51} \frac{50}{51}$, small, acute. Vertebral formula $C_7D_{14}LCd_{54}=75$.
Northmaven, Shetland, 1895.

Donor—Thos. Anderson, Esq.

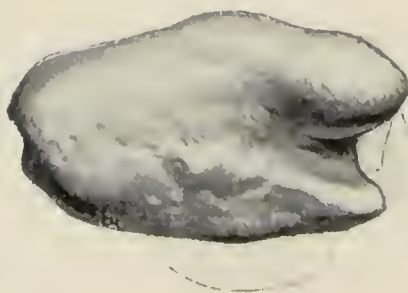
3. **Skull**, with mandible. Length $17\frac{3}{4}$ inches, breadth $7\frac{1}{4}$ inches. Beak, length 11 inches, breadth at base $3\frac{5}{8}$ inches, breadth at middle 2 inches. Nasals and transverse ridge on vertex on same plane; premaxillaries concave in front of nares, then narrow and convex nearly to the pointed tip; pterygoids moderate, meeting mesially; hard palate with a strong mesial ridge, on each side of which is a deep, broad groove. Symphysis of mandible $2\frac{1}{4}$ inches. Teeth small, acute, $\frac{46}{42} \frac{46}{42}$.

4. **Rostrum** with broken mandible. Beak $10\frac{1}{2}$ inches long, $3\frac{3}{8}$ inches broad at base. Symphysis 2 inches long. Palate with broad mesial ridge, on each side of which is a groove, deep behind, shallow in front. Teeth simple, conical, $\frac{47}{47} \frac{47}{47}$.

5. **Mandible**, length $16\frac{1}{4}$ inches, height $2\frac{5}{8}$ inches; symphysis, length $2\frac{5}{8}$ inches. Teeth in each half 49, small, acute.

6. **Tympano-periotic** bones, pair of, articulated. Tympanic, length $1\frac{1}{4}$ inch, breadth $\frac{5}{8}$ inch, height $\frac{1}{2}$ inch. Bilobed, inner flattened laterally, small, rough, and pointed; outer larger, rounded, and smooth. Periotic, length $1\frac{1}{8}$ inch, breadth $\frac{1}{2}$ inch. Tympanic ossicles present. From No. 1. See figure of tympanic below.

Dalmeny.



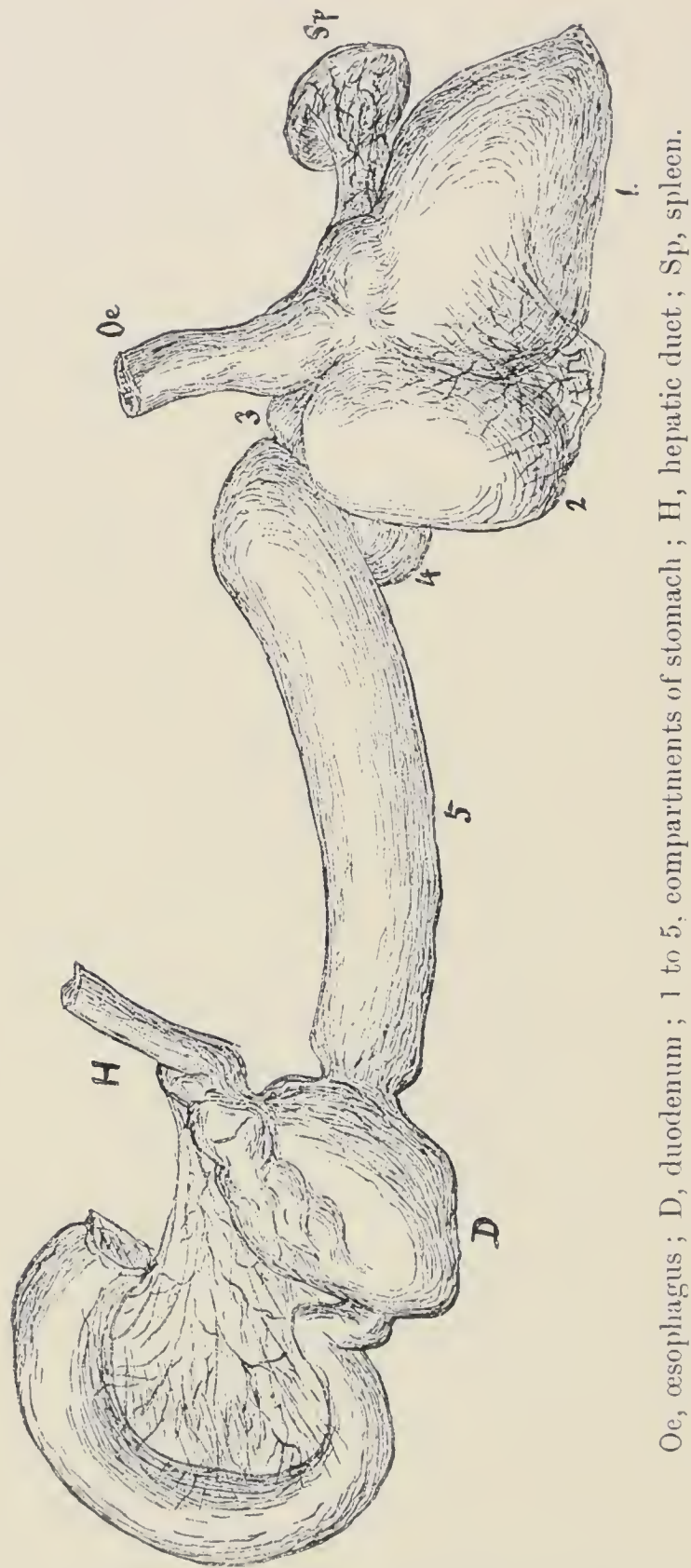
7. **Tympano-periotic** bones, pair of articulated. Tympanic, length $1\frac{3}{8}$ inch, breadth $\frac{3}{4}$ inch, height $\frac{1}{2}$ inch. Periotic,

length $1\frac{1}{4}$ inch, breadth $\frac{1}{2}$ inch. Outer surface of tympanic convex, anteriorly flattened behind the lip-like process; inner surface, $\frac{3}{8}$ inch in height, sloping rapidly to Eustachian end; bilobed as in No. 6. Tympanic ossicles present. From the Shetland specimen, No. 2.

8. **Tympano-periotic** bones, right, from No. 3; the left bones are attached to the skull. Tympanic, length $1\frac{3}{8}$ inch, breadth $\frac{3}{4}$ inch; periotic, length $1\frac{1}{4}$ inch, breadth $\frac{1}{2}$ inch. Tympanic ossicles loose.
9. **Manus**, right, dorsal surface; R, radius; U, Ulna; *r*, radiale; *i*, intermedium; *u*, ulnare; distal carpale i, carpale ii, and a carpale representing C iii + C iv; *p*, pisiform cartilage; P, pollex; I to V, five metacarpals.



10. **Stomach** of Common Dolphin, inflated and dried. From the Dalmeny specimen, No. 1. The 1st cesophageal compartment or paunch is $5\frac{1}{4}$ inches long; the 2nd or cardiac compartment is subglobular, $3\frac{1}{2}$ by $2\frac{3}{4}$ inches; the 3rd and 4th compartments are intermediate, the 3rd not as large as a walnut, the 4th the size of a walnut; the 5th pyloric is tubular, 10 inches long, joins the subglobular dilatation of the duodenum. (Figure on page 134.) The stomach in the fresh state is described by Turner in *Journ. Anat. and Phys.*, vol. xxiii., 1889.



Oe, œsophagus ; D, duodenum ; 1 to 5, compartments of stomach ; H, hepatic duct ; Sp, spleen.

11. **Kidney** of same, capsule removed, numerous small lobules exposed, artery injected red. From No. 1.

XIII. TURSIOPS. (T.)

Tursiops, *Gerrais, Hist. Nat. Mamm.*, iii. 1855.

Beak pointed, moderate, bounded by a definite line ; pterygoids in contact mesially : colour dark grey on

dorsum; venter greyish white and white. Palate not raised mesially into a ridge nor grooved laterally. Vomer visible in middle line of palate.

(1) TURSIOPS TURSIO. (T. T.)

(Common Tursio.)

Delphinus tursio, *Fabricius, Fauna Grœnl.*, 1780.

Tursio truncatus, *Gray, Cat. Seals and Whales*, 1866.

Colour leaden grey generally, white ventrally; length up to 10 feet; dorsal fin high, falcate, about middle of length; pectoral limb slightly falcate; vertebral formula $C_7D_{13}L_{17}Cd_{27}=64$. Teeth fewer and stronger than in *D. delphis*.

1. **Skull**, adult, with mandible; length $21\frac{1}{2}$ inches; breadth $10\frac{3}{4}$ inches. Beak, length $12\frac{1}{2}$ inches; breadth at base $5\frac{3}{4}$ inches, about middle $3\frac{3}{4}$ inches. Nasals, frontal and transverse ridge on vertex on same plane; premaxillæ concave in front of nares, then convex to the somewhat pointed tip; pterygoids moderate, meeting mesially. Length of mandible $18\frac{1}{2}$ inches. Length of symphysis $3\frac{1}{4}$ inches. Teeth moderate, worn, $\frac{24}{22} \frac{24}{22}$.

Loch Long, 1879.

Donor—Dr D. Noel Paton.

2. **Skull**, with mandible, from a younger animal; length 18 inches, breadth $9\frac{1}{4}$ inches. Beak, length 10 inches; breadth at base $4\frac{1}{2}$ inches. General characters as in No. 1. Teeth moderate, sharp, $\frac{22}{22} \frac{22}{22}$.

Delny, Ross-shire, 1898.

Donor—Wm. Taylor, Esq., Lhanbryde.

3. **Mandible**, length 16 inches, greatest height $3\frac{1}{8}$ inches, symphysis $1\frac{5}{8}$ inch. Teeth absent, but twenty sockets in each half.

Barbados.

Donor—Dr F. B. Archer.

4. **Tympano-periotic** bones, pair of; tympanic, length $1\frac{1}{2}$ inch, breadth 1 inch; periotic, length $1\frac{5}{8}$ inch; breadth $\frac{7}{8}$ inch. Tympanic bilobed, with wide notch intervening; outer lobe rounded and smooth, inner lobe flattened, rough, and continued into a rough ridge which separates the internal from the inferior surfaces. Outer surface convex anteriorly, flattened behind the

lip-like process. Ossicles present. From No. 1. See figure below.
Loch Long, 1879.



5. **Sternum**, manubrium, with first pair of ribs fused with sternum. From No. 1.
6. **Rib**, second right, costal cartilage broad and ossified. From No. 1.
7. **Scapula**, left; posterior angle, coracoid and acromion injured. From No. 1.

(2) *TURSIOPS CATALANIA*. (T. C.)

Tursiops catalania, Gray, *Proc. Zool. Soc.*, 1862.

Beak relatively longer than in *tursio*, more than half the length of the skull. Colour as in *tursio*, but with darker patches on the under surface of the body. Habitat, north-east coast Australia. Not so large as *Tursiops tursio*.

1. **Skull**, with mandible; length $17\frac{1}{4}$ inches, breadth 8 inches. Beak, length 10 inches; breadth at base $3\frac{3}{4}$ inches, about middle $2\frac{3}{8}$ inches. Nasals, frontal and transverse ridge on vertex in same plane; premaxillæ concave in front of nares, then convex down to pointed tip. Teeth moderate in size, pointed, but somewhat worn, $\frac{26}{22} \frac{26}{22}$. Turner Collection.
2. **Skull**, adult, with mandible. Length $17\frac{1}{4}$ inches, breadth 8 inches; beak, length $10\frac{1}{4}$ inches, breadth at base $4\frac{1}{4}$ inches. Nasals, frontal and vertex cranii on same plane; premaxillæ concave in front of nares as far as their foramina, then convex in beak, the bone being $\frac{3}{4}$ inch broad in middle of beak, pterygoids moderate in size, meeting mesially; palate not grooved, vomer

appearing in palate between the two superior maxillæ. Symphysis of mandible $2\frac{3}{4}$ inches long.

Teeth moderate, acute, $\frac{35}{34} \frac{35}{34}$.

Purchased—Woodcock Collection.

XIV. PRODELPHINUS. (PD.)

Prodelphinus, Gervais, *Ostéogr. des Cétacés*.

Allied to *Delphinus*, from which it is distinguished by the absence of deep lateral palatine grooves; also allied to *Tursiops*, though with smaller and more numerous teeth and generally more numerous vertebræ (True). Several species from North Atlantic to Cape Horn and the Cape of Good Hope.

(1) PRODELPHINUS. Species undetermined.

1. **Skull**, without mandible. Length 15 inches, breadth $6\frac{5}{8}$ inches; beak, length 9 inches, breadth at base $3\frac{1}{2}$ inches; nasals in plane of vertex; premaxillæ faintly concave in front of nares, extending towards middle of beak, then convex and smooth to about the tip. Superior maxillæ do not unite in anterior two-thirds of hard palate, and vomer appears in interval. The pterygoids are broken. Teeth small, acute, $\frac{36}{36} \frac{36}{36}$.

Locality not specified. Dr R. Broom's Collection.

2. **Skull**, with mandible. Length 16 inches, breadth $6\frac{3}{4}$ inches; beak $9\frac{3}{4}$ inches long, breadth at base $3\frac{1}{4}$ inches. Nasals in same plane as vertex cranii. Pre-maxillæ concave in front of nares, then convex in beak and 1 inch broad in its middle; pterygoids large, meeting mesially; symphysis of mandible $2\frac{1}{2}$ inches long. Teeth small, acute, $\frac{33}{33} \frac{33}{33}$. Said to have been brought from Madagascar. Purchased.

3. **Skull**, with mandible. Length 16 inches, breadth $6\frac{1}{2}$ inches; beak, length 10 inches, breadth at base $3\frac{1}{4}$ inches. Nasals in plane of vertex cranii; premaxillæ slightly concave in front of nares as far as its foramina, convex in beak, becoming attenuated at tip; ptery-

goids united mesially; symphysis $2\frac{3}{4}$ inches long.

Teeth small, acute, $\frac{40}{37} \frac{40}{37}$. Locality not specified.

4. **Skull**, adult, with mandible. Length $14\frac{1}{4}$ inches, breadth $6\frac{3}{4}$ inches; beak, length 8 inches, breadth at base $3\frac{1}{4}$ inches. Nasals in plane of vertex cranii; premaxillæ with shallow concavity to about middle of beak, then flattened; hard palate showing vomer in middle line, pterygoids broken; symphysis of mandible $1\frac{1}{4}$ inch long. Teeth small, acute, $\frac{31}{34} \frac{31}{34}$. Locality not specified. Donor—Mr Brotherston, Kelso.

[Many species have been included in the genus *Prodelphinus*: F. W. True names twenty-three, several of which are founded on single skulls and without doubt will need revision. I have placed four skulls in the Museum in this genus, and I have examined one in Mr W. Taylor's Collection which he regards as belonging to it. These skulls have the character of *Prodelphinus*, but differ in some features from each other, and may be arranged in two groups; in the one the skull is longer and wider, the beak is somewhat broader in relation to its length, and the premaxillaries are more convex and distinctly broader in the beak than in the other. These characters might be regarded as specific, but with the paucity of material for comparison at my disposal I am not prepared to apply to these skulls specific names.]

5. **Mandible**. Length $13\frac{1}{4}$ inches, greatest height $2\frac{3}{8}$ inches; symphysis, length of, $1\frac{7}{8}$ inch. Teeth 35 in each half, small, acute.

Barbados, 1869.

Donor—Dr F. B Archer.

XV. STENO. (St.)

Steno, Gray, *Zool. Erebus and Terror*, 1846.

Colour black on dorsum, white on venter. Dorsal fin falcate. Beak long, compressed, marked off from forehead. Symphysis of mandible long. Teeth moderate, crowns faintly ridged, 20 to 27 in each half of jaws.

(1) STENO ROSTRATUS. (St. R.)

Delphinus rostratus, G. Cuvier, Desmarest, and F. Cuvier.

Steno frontatus, Gray, *Cat. Seals and Whales*.

Steno rostratus, Gervais, *Ostéogr. Cét.*, 1880.

Mandible gradually attenuated from behind forwards, not keeled at symphysis. Length of animal about 9 feet; length of skeleton about 8 feet; of skull 20 inches. Vertebral formula $C_7D_{13}L_{15}Cd_{30} = 65$.

1. Mandible, tip broken, length $16\frac{1}{2}$ inches. Length of symphysis $5\frac{1}{2}$ inches, one-third length of mandible; symphysis, transverse diameter $\frac{3}{4}$ inch at free end, at posterior end $1\frac{3}{4}$ inch. Posterior end with condyl, coronoid and sharp angle; height from coronoid to angle $3\frac{1}{4}$ inches; between outer edge of condyls $7\frac{5}{8}$ inches. Teeth moderate, pointed, $\overline{23} \overline{23}$. Mandible expresses a skull with long, narrow, pointed beak.

Purchased, Woodcock Collection, 1887.

XVI. SOTALIA. (So.)

Sotalia, Gray, *Cat. Seals and Whales*, 1860.

Allied to *Steno* and *Tursiops*, in it the pterygoids are separate, the caudal vertebræ are less numerous and the teeth are more numerous (True); symphysis of mandible is usually long. Several species have been described. Habitat: some in rivers in China, West Africa, the Amazon, others in the South Atlantic, and the coast of Malabar.

No specimen in Museum.

XVII. FERESA. (Fe.)

Feresa, Gray, *Suppl. Cat. Seals and Whales*, 1871.

Ferezia, Flower, *Proc. Zool. Soc.*, 1883; *Catalogue of Cetacea*, 1885.

Defined by Dr Gray as with a flat beak, gradually tapering in front; width at maxillary notch two-thirds of entire length of beak; lower jaw slender, narrow and thin in front. Teeth not reaching notch, 10 to 12 in each half of each jaw. Known by only two skulls. South Seas.

No specimen in Museum.

SPECIES UNDETERMINED.

1. **Occipital** bone, probably of a young *Balænoptera*. Diameter from anterior lip of foramen magnum to vertex border $22\frac{1}{2}$ inches, greatest transverse diameter 29 inches; foramen magnum 4 inches in sagittal, $3\frac{1}{4}$ inches in transverse diameter; basi-occipital joint open.
2. **Vertebræ**, Cervical, and five anterior Dorsal. The cervicals from 1st to 6th fused into one block, 7th free, with costal articular facet on side of body, but not on transverse process. Dorsals free, with articular facet on side of body and tip of transverse process. Atlas, transverse diameter $12\frac{1}{4}$ inches, supero-inferior $5\frac{1}{4}$ inches. From New Zealand, 1872; also the succeeding specimens, Nos. 3, 4. Donor—Sir James Hector.
3. **Vertebræ**, Cervical, and two anterior Dorsal, similar in character to above.
4. **Vertebræ**, Cervical, and two anterior Dorsal, similar in character to above.
5. **Brain** of a large Cetacean, membranes removed and the system of small convolutions exposed. The optic commissure with its nerves, and the nerves which arise from the pons and medulla, have been dissected. The brain shows the characteristic compression; the sagittal diameter of a hemisphere is $5\frac{1}{8}$ inches, and the breadth of the two hemispheres is $8\frac{1}{2}$ inches.
6. **Brain** of a Cetacean; the arachnoid and pia have not been removed. The sagittal diameter of a hemisphere is $5\frac{3}{4}$ inches, and the greatest transverse diameter of the two hemispheres is $7\frac{3}{4}$ inches.
7. **Penis**. Dried specimen 4 feet 10 inches long, bulbous and $8\frac{5}{8}$ inches in girth at the deep end, gradually tapering to a point at the free end. The specimen was originally in the University Museum of Natural History, and is probably that described in the *Auctarium Musei Balfouriani, e Museo Sibbaldiano*, Edinburgh, 1697, as "Penis *Balænæ Orcadensis*. The Pisle of a Whale which came in at Orknay."
8. **Fœtus**, male, of a Cetacean, species undetermined; length $4\frac{1}{4}$ inches. Dorsal fin about midway between the head and the end of the tail.

PART II.

ORDER SIRENIA. (SIR.)

SEA COWS.

INTRODUCTION.

THE SIRENIA, owing to their aquatic life and fish-like shape, were regarded by the Cuviers and their immediate successors as belonging to the order Cetacea, and were named Herbivorous Cetacea. Further observations into their habits and structure have shown that they differ materially from the Cetacea, and they have had to be removed therefore from that order. As they also differ much from other orders of Mammals, and cannot be classified with any one of them, these animals have to be placed in an Order apart, and the name Sirenia, proposed by Illiger, has been adopted by zoologists.

As regards their habits, they live in the brackish water of large rivers, estuaries, bays, lagoons, and do not frequent the open sea. They feed on the seaweeds and other aquatic plants which grow in these waters. They are deliberate and inactive in their movements. They frequent the east and west coasts of Africa, the Red Sea, the Bay of Bengal, the Malay Archipelago, the north coast of Australia, the West Indies, some of the great rivers of South America, and up to the latter half of the eighteenth century one species lived in the Behring Sea.

In their external characters, the skin is not smooth and shining as in the Cetacea, but is rough, wrinkled and sparingly studded with hairs; the muzzle is truncated, and on its summit the nose opens by two orifices; the lips are provided with short, stiff bristles; the body is fusiform; the palpebral fissure and eye are very small; the ear has no pinna; there is no dorsal fin; the caudal fin is horizontal, laterally expanded, and in *Halicore* has a notch on the posterior border; the pectoral limbs are pentadactylous, enclosed in a common envelope of skin, paddle-shaped; the pelvic bones are present, but rudimentary; there are no hind limbs. The head is not large in relation to the size of the body.

In their internal structure, the brain is smaller than in the active-moving Cetacea of corresponding size, and the cerebrum is not so minutely convoluted. The heart is cleft at the apex. The epiglottis is not intranarial. The stomach consists of two large compartments, œsophageal and pyloric, and of two intermediate accessory cavities: a special glandular pouch opens into the œsophageal compartment. An ileo-colic valve marks the separation of the small from the large

intestine ; two cæcal appendages open into the commencement of the colon in *Manatus*, but in *Halicore* the cæcum is simple. The kidneys are simple and not multilobate as in the Cetacea. The placenta in the *Dugong* is arranged as a zone, and the villi are not diffused over the surface of the chorion as in the Cetacea. In the shape and arrangement of the teeth and in their order of succession the *Sirenia* contrast strongly with the Cetacea. The incisor and molar teeth are separated from each other by a wide interval. The bones are dense and heavy ; the anterior nares are large and set back. The vertebræ are not fused together to form a sacrum ; in their ossification they do not form plate-like epiphyses. Chevron bones are developed in the anterior caudal region. In *Manatus* there are only six cervical vertebræ. As in the Cetacea, the clavicles are not developed. The carpus is short, but has some breadth.

Three families are recognised in the order *Sirenia* : *Halicoridæ*, *Manatidæ*, *Rhytinidæ*. The Museum contains twenty-two specimens.

SPECIMENS OF SIRENIA.

Family 1. HALICORIDÆ.

(Represented by a single genus.)

I. HALICORE. (Hal.)

Illiger, Prod. Syst. Mamm. et Avium, 1811.

Skull with rostrum or beak formed by a pair of premaxillæ which are bent greatly downwards; symphysial end of lower jaw also bent downwards, rough surface supports horny plate. No nails on pectoral limbs. Tail horizontal, flanged. No dorsal fin.

(1) HALICORE DUGONG. (HAL. D.)

(Dugong, Indian Dugong.)

Halicore Dugong, *Illiger, op. cit.*

Length 8 to 10 feet. Colour bluish black on dorsum, venter greyish white; muzzle with thick lips. Vertebral formula $C_7D_{19}L_5Cd_{28} = 59$.

The figure below represents a male foetus 5 feet 4 inches long, measured along the dorsal curve. The skin was smooth, dull yellowish grey colour, lighter



on the belly. Scattered delicate silky hairs were more numerous on head and body than on limbs and tail; a short, stiff white moustache grew from the muzzle. No dorsal fin nor hind limbs; pectoral limb 7 inches long, $3\frac{3}{4}$ broad. Tail lobed.

1. **Skeleton**, adult, male; length 8 feet $6\frac{1}{2}$ inches. Skull in straight line $16\frac{1}{2}$ inches, over curve of vertex $22\frac{1}{2}$ inches. Spine, length 7 feet 2 inches; 19 pairs of ribs; 15 chevron bones, in the last five of which the lateral halves are not fused mesially; 5 lumbar vertebræ intervene between 1st chevron and last rib. Vertebral formula $C_7D_{19}L_5Cd_{28}=59$. Anterior nares 3 inches in transverse, $4\frac{7}{8}$ in sagittal diameter. Beak formed by two large premaxillaries which lodge the tusks; these bones slope downwards from the anterior nares for $8\frac{1}{8}$ inches. Mandible massive, 11 inches long; condyl flattened, relatively small; coronoid pointed, projects $2\frac{1}{4}$ inches, angle large, from it to condyl 7 inches; anterior end of bone broad, sloping downwards in symphysial region for 5 inches and showing four tooth sockets on right side and five on left. Humerus without supra-condyloid foramen. Pair of pelvic bones, slightly curved; length $8\frac{1}{4}$ inches, attenuated at vertebral end, broader below. The skeleton was received roughly cleaned; it was carefully macerated and articulated so as to preserve the bones and their relative positions. Front of face in Plate XVI.

Queensland.

Donor—Sir Wyville Thomson.

2. **Skeleton**, immature; ex-occipitals partially fused with basi-occipital, supra-occipital lost. Length 6 feet $6\frac{3}{4}$ inches. Skull, length in straight line $12\frac{1}{2}$ inches, over vertex $20\frac{1}{4}$ inches. Spine, length 5 feet $6\frac{1}{4}$ inches; 19 pairs of ribs; only 7 chevrons present; 5 lumbar vertebræ. Vertebral formula $C_7D_{19}L_5Cd_{29}=60$. Compared with No. 1, the spine is more complete. Anterior nares $2\frac{3}{4}$ inches in transverse and $4\frac{1}{8}$ in sagittal diameter; premaxillæ slope down from anterior nares for $6\frac{5}{8}$ inches. Mandible not so large as No. 1, with four pairs of tooth sockets at symphysis. Right pelvic bone $5\frac{1}{4}$ inches long, consisting of an upper vertebral segment and a lower ventral segment fused about the middle of the bone, but with the original plane of separation distinct.

East Indian Seas.

Knox Collection, No. 107.

3. **Skull**, bisected, 12 inches long in straight line, over vertex 20 inches. Anterior nares $2\frac{1}{2}$ inches in transverse, $4\frac{1}{2}$ in sagittal diameter; premaxillæ slope down $6\frac{1}{2}$ inches from anterior nares to tip, and contain left tusk; for right, see No. 6. Mandible not so large as in No. 1, and with four pairs of tooth sockets in symphysis. Knox Collection, No. 108.
4. **Skull**, immature. The supra-, ex-, and basi-occipital not fused with each other, and the last-named separate from the sphenoid. Length of skull in straight line $12\frac{1}{4}$ inches, $18\frac{1}{2}$ inches over vertex. Anterior nares $2\frac{1}{2}$ inches in transverse and $3\frac{3}{4}$ in sagittal diameter; premaxillary beak from anterior nares to tip $5\frac{3}{4}$ inches. Mandible not so massive, length 8 inches, height from condyl to angle 5 inches, length of symphysis $3\frac{3}{8}$ inches, four pairs of tooth sockets. Queensland. Donor—Sir Wyville Thomson.
5. **Skull**, Cast of; right premaxillary beak cut to display a large tusk in its socket. Anterior nares 3 inches transverse diameter, $4\frac{3}{4}$ in sagittal.
6. **Tusk**, outer half of right, from No. 3; $6\frac{1}{2}$ inches long. It had been bisected and the pulp cavity, $2\frac{1}{8}$ inches long, exposed. A mesial line extends through the substance of the tooth from the apex of the pulp cavity to the free end of the tooth.

Knox Collection, No. 109.

As the skulls were of different ages, an opportunity to study different stages of dentition was given. In the youngest skull, No. 4, the symphysial part of the Mandible had four wide, shallow sockets in which there were no teeth. In the skull No. 3, the corresponding sockets were wider and deeper; each of the third pair contained a rudimentary styloid tooth thickened at its deep end, the others were empty. In the skull of No. 2 the sockets were moderately wide, deep, and empty. In No. 1, the oldest skull, the sockets were empty, four large on the right side, but on the left a small socket was interposed between the large second and third, making five in all. The molar teeth in the mandible were worn and flattened on the surface of the crown. In the youngest skull, No. 4, were six sockets with four teeth with flattened crowns on each side. The anterior tooth was lost; the most posterior contained an unerupted tooth with a

tuberculated crown. In No. 3 were three pairs of molar teeth, of which the posterior, $\frac{7}{8}$ inch in sagittal and $\frac{1}{2}$ inch in transverse diameter, was the largest. In No. 2 five pairs of sockets were present, in which only two teeth had been preserved. In No. 1 only three sockets were on each side; the tooth in the middle socket measured $1\frac{1}{8}$ by $\frac{5}{8}$ inch; the hindmost tooth had been lost.

In the Upper Jaw the premaxillary or incisor teeth assumed in the older skulls the form of tusks. The youngest skull, No. 4, had two sockets in each premaxilla, separated by a transverse septum, each of which contained an unerupted tooth; the anterior was styliform, and the posterior about three times thicker. In No. 3 each premaxilla had only a single large socket for a tusk, of which the left was preserved; the socket was $4\frac{7}{8}$ inches deep, $1\frac{1}{8}$ inch wide. In No. 1 the tusk was present in each premaxilla; it projected $2\frac{1}{8}$ inches, and its circumference at the mouth of the socket was $3\frac{1}{2}$ inches. In No. 4 the maxillary or molar teeth had six sockets on each side: in the most anterior the tooth was cylindriform and only $\frac{1}{8}$ inch in diameter; the 2nd, 3rd, and 4th were flattened on the crown; the 5th had recently erupted and was tuberculated, the 6th was concealed in the socket. In No. 3 were three pairs of sockets, and the posterior on one side contained a worn tooth $\frac{3}{4}$ by $\frac{1}{2}$ inch in diameter. In No. 2 were five sockets on each side, but only three teeth with worn crowns had been preserved. In the oldest skull, No. 1, were only two sockets and two pairs of teeth.

From these observations it would appear that in early life two incisor teeth arise in each premaxilla, but that one disappears, whilst the other increases greatly in size and forms the tusk. At the stage in which the four incisors were seen in the youngest skull, the more posterior in each bone was the larger, from which it would seem as if it developed into the tusk and caused the absorption of the anterior tooth. As regards the molar teeth, six is the number developed on each side, but they are not all erupted at the same time, for when the 1st is in place the 6th is still concealed, and before it appears the 1st and perhaps the 2nd may be shed, so that in the course of time four, three, or only two molars, and these the most posterior, may be all that remain on each side. The

succession of teeth in this animal is not therefore a vertical succession, but in the horizontal direction, as is the case with the true molars in man, or as is seen on a large scale in the molar region in the elephant.

7. **Sternum**, 1st and 2nd pairs of **Ribs**, cervical **Vertebræ**, 1st and 2nd dorsal. Sternum 8 inches long, divided into two segments, the anterior $4\frac{1}{2}$ inches, the posterior, $3\frac{1}{2}$ inches, is not bifurcated at its free end; greatest breadth about the middle $2\frac{3}{8}$ inches. Three pairs of costal cartilages articulate with the sternum near its middle, one and a half to the anterior segment, one and a half to the posterior. Seven Cervical Vertebræ, the anterior part of the head of the 1st rib articulates with the side of the body of the 7th, the posterior part with the body of the 1st dorsal. The tubercle of the 1st rib articulates with the transverse process of the 1st dorsal and not with that of the 7th cervical.

In the immature skeleton, No. 2, the sternum, in its size, form, and costal articulations, closely resembles that in No. 7, and the articulations of the vertebral end of the 1st rib are similar. In the adult skeleton, No. 1, the sternum is bifurcated at its posterior end and notched anteriorly; its mesial length is 10 inches, whilst laterally it is $11\frac{1}{2}$ inches; the greatest breadth is $3\frac{5}{8}$ inches. The vertebral articulations of the 1st rib correspond with Nos. 2 and 7. The spines of the atlas and axis, 3rd and 4th vertebræ are ossified, but in the 5th, 6th, and 7th the two halves are still asunder. In the immature skeleton the atlas and axis only are completely ossified.

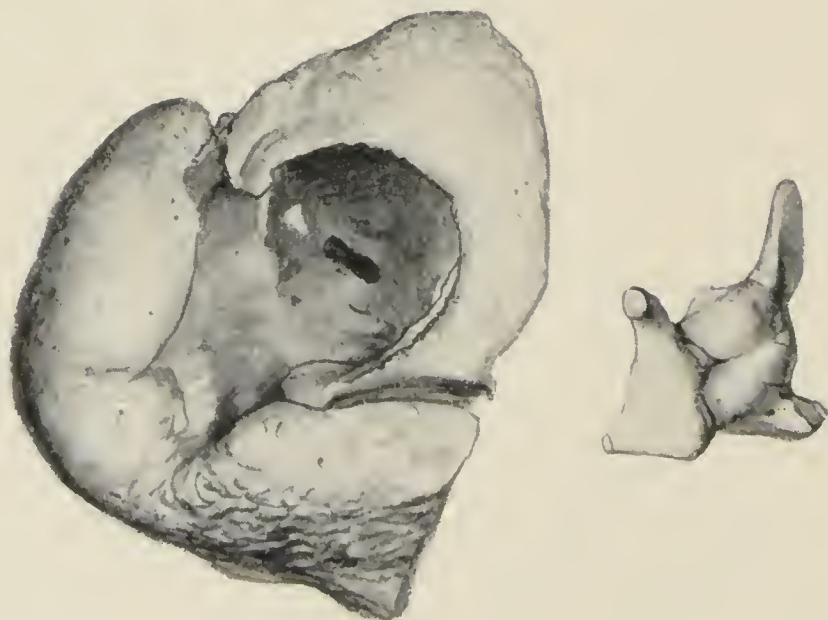
8. **Pectoral** Limbs, pair of. Scapula falciform, vertebral and anterior borders convex, anterior angle feeble, posterior distinct, coracoid and spines present, acromion short, pre-spinous larger than post-spinous fossa. Humerus from head to outer condyl $5\frac{3}{4}$ inches, upper epiphysis for head and tuberosities not fused with shaft, lower fused, upper half of shaft broad and deeply grooved. Radius and ulna each with upper epiphysis fused, lower not yet united; olecranon well marked, epiphysis on its tip not fused. Radius $4\frac{3}{8}$ inches long, ulna $5\frac{1}{2}$ inches. Carpus with proximal and distal rows; the proximal contains radiale and ulnare but no intermedium, the distal consists of a single bone stretching across the carpus and articulating with five metacarpals; between the

2nd and 3rd metacarpals it shows evidence on the surface of fusion of two originally separate bones. The pollex consists of M_i and no phalanx; M_{ii} had two phalanges, M_{iii} three phalanges, M_{iv} three phalanges, M_v , minimus, two phalanges.

In the adult skeleton, No. 1, the scapula is $12\frac{5}{8}$ inches in long diameter, $5\frac{1}{2}$ inches in glenoido-vertebral; the coracoid projects $1\frac{1}{4}$ inch, the acromion $1\frac{1}{2}$ inch from the spine. The humerus is $7\frac{1}{4}$ inches long, radius $5\frac{1}{2}$ inches, ulna 7 inches, epiphyses all fused; the carpus has the same number and arrangement of bones as the above specimen; the metacarpals and phalanges also correspond, except that the pollex has a minute phalanx and the index has three phalanges.

The skeleton No. 2 closely resembles No. 8, but the carpal radiale has been lost.

9. **Tympano-periotic** bones, right, of the Dugong, No. 4 in Catalogue. The tympanic is an imperfect ring, the broad end of which is directed downwards, forwards, and inwards, and is swollen on its posterior surface. The two cornua of the ring are fused with the periotic, and the longest diameter is $1\frac{4}{10}$ inch; in form the tympanic is like the cartilaginous pinna of the human ear, but without a tubular meatus. Continuous with the periotic is an ovoid projection which occupies a concave surface in the squamous temporal. The periotic, consisting of dense bone, is 2 inches in its longest diameter. The chain of ossicles has been removed from the tympanic cavity and is figured to the right of the outer surface of the tympano-periotic.



10. **Heart** of a Dugong, showing the separation of the two ventricles at the apex by a deep cleft. The cavities have been opened into and the valves exposed.

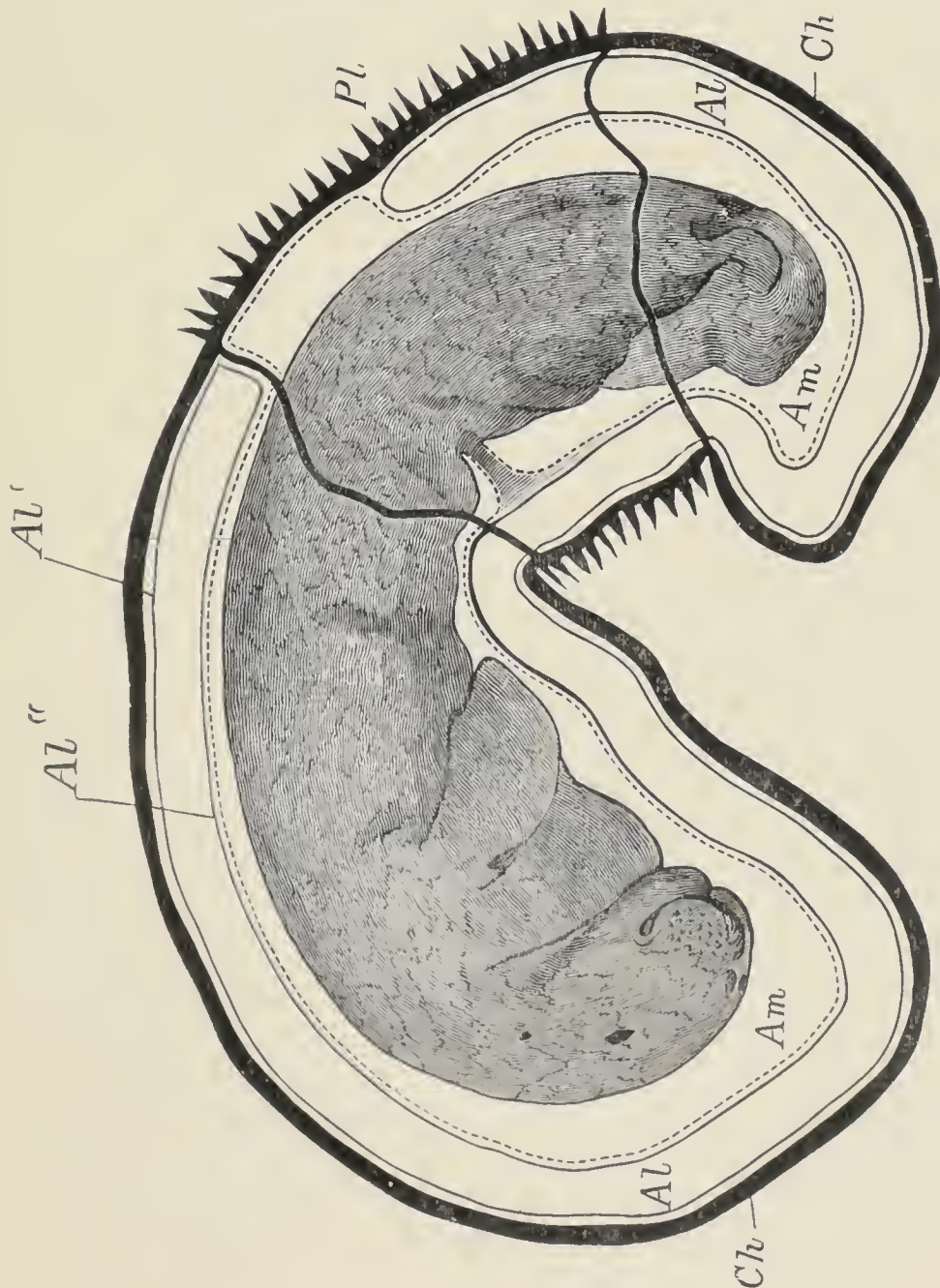
Knox Collection, No. 116.

11. **Kidney** of Dugong, not lobulated, bisected longitudinally; the pelvis is opened into and the apices of the pyramids are exposed; bristles have been placed in the opening of the ureter.

12. **Kidney** of Dugong, not lobulated, bisected; the relation of the calyces to the mammillary apices of the pyramids is shown.

Knox Collection, No. 121.

[The drawings Nos. 13 to 18 are described and repro-



duced from Sir Wm. Turner's memoir on the foetus of Halicore and Manatus in *Journ. Anat. and Phys.*, xxviii., 1894. They show the changes in the form of the head and face of the Dugong which take place during development, from a foetus $5\frac{1}{2}$ inches long to one 5 feet 4 inches, and subsequently to adult growth.]

13. **Dugong**, foetal, male, diagram of, enclosed in its membranes. Ch., chorion, with Pl., the zonary placenta, excentric in position and more in proximity to the left tuba than to the corpus uteri. Al., the sac of the allantois; Al', endochorionic layer of allantois; Al'', layer of allantois next the amnion represented by a dotted line; Am. is in the sac of the amnion. The foetus is also figured on p. 145. The gravid uterus and placenta are described and figured by W. Turner, in his memoir on the Placentation of the Dugong, *Trans. Roy. Soc. Edin.*, vol. xxxv., part 2, 1889. See figure on page 151.

14. **Dugong**, profile view of the above young male foetus, size of nature, $5\frac{1}{2}$ inches from the muzzle along the dorsum of the head and spine to the mid-point of the tail. The head, tail, penis, and pectoral limb with the pentadactylous manus are shown.

Donor—C. W. de Vis, M.A., of the Queensland Museum, Brisbane.

15. **Dugong**, front of the face of the same foetus, $\times 2$. The muzzle, mouth, lips, nostrils, and eyes can be recognised. See upper figure on page 153.

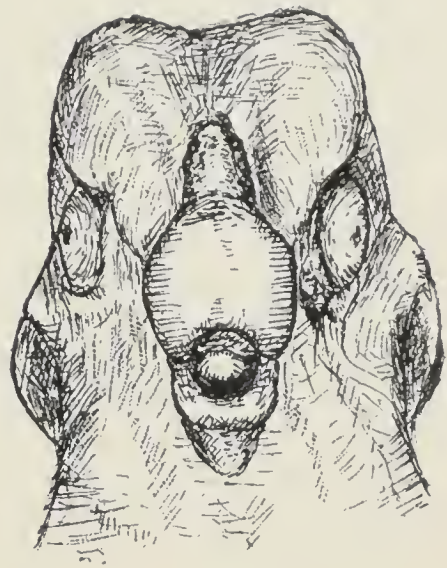
16. **Dugong**, head of a larger foetus, size of nature: length in a straight line $4\frac{1}{8}$ inches, zygomatic breadth 3 inches, from nostril to mouth $1\frac{3}{4}$ inch. See lower figure on page 153.

Queensland.

Donor—Sir Wyville Thomson.

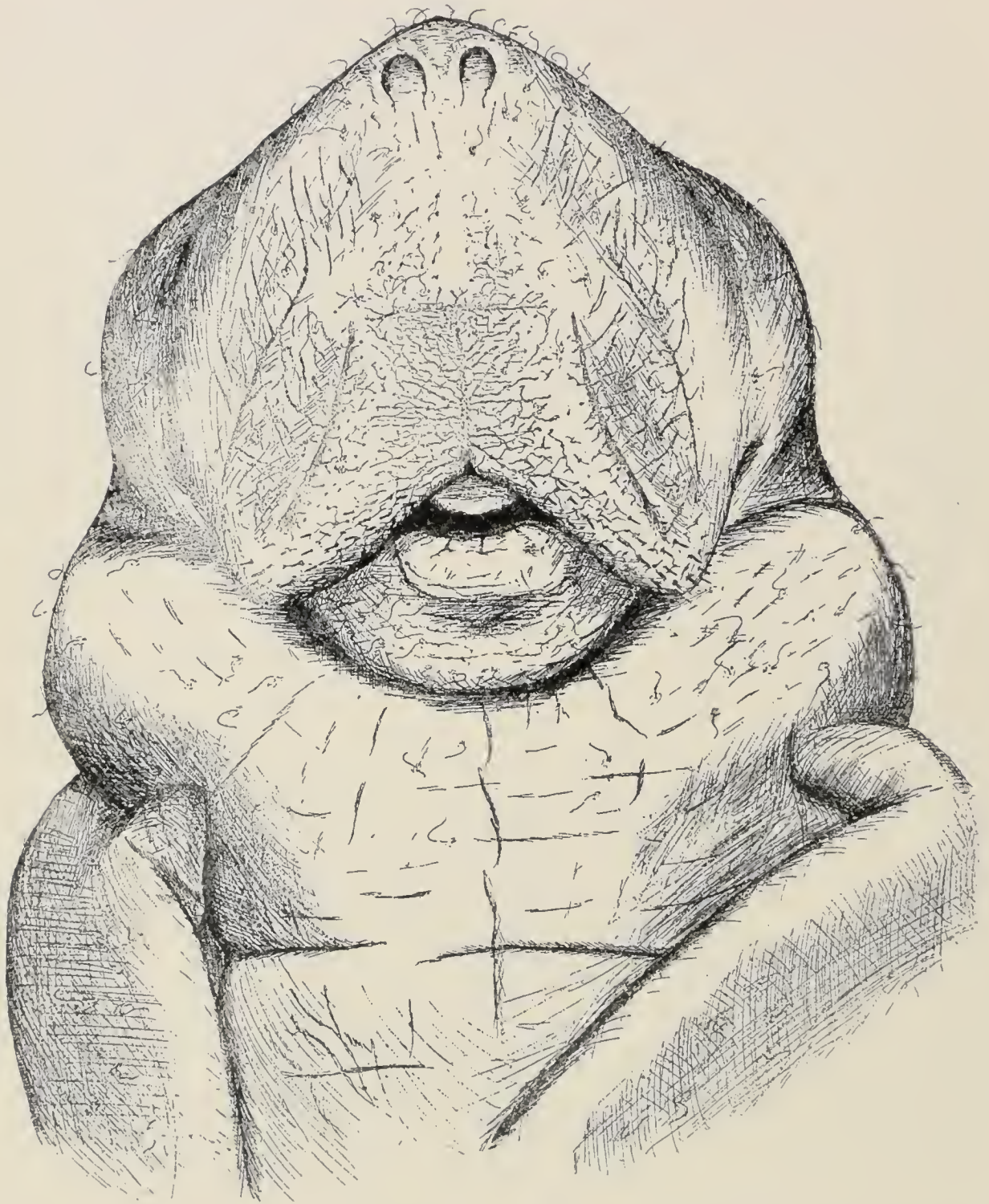
17. **Dugong**, front view of head and pectoral region, reduced one-half, of the foetus figured on p. 145. The characters of the face from the nostrils to the chin, with the scattered hairs, are shown, and the origin of the pectoral limbs. See figure on page 154

Donor—C. W. de Vis, M.A., Queensland.



× 2.

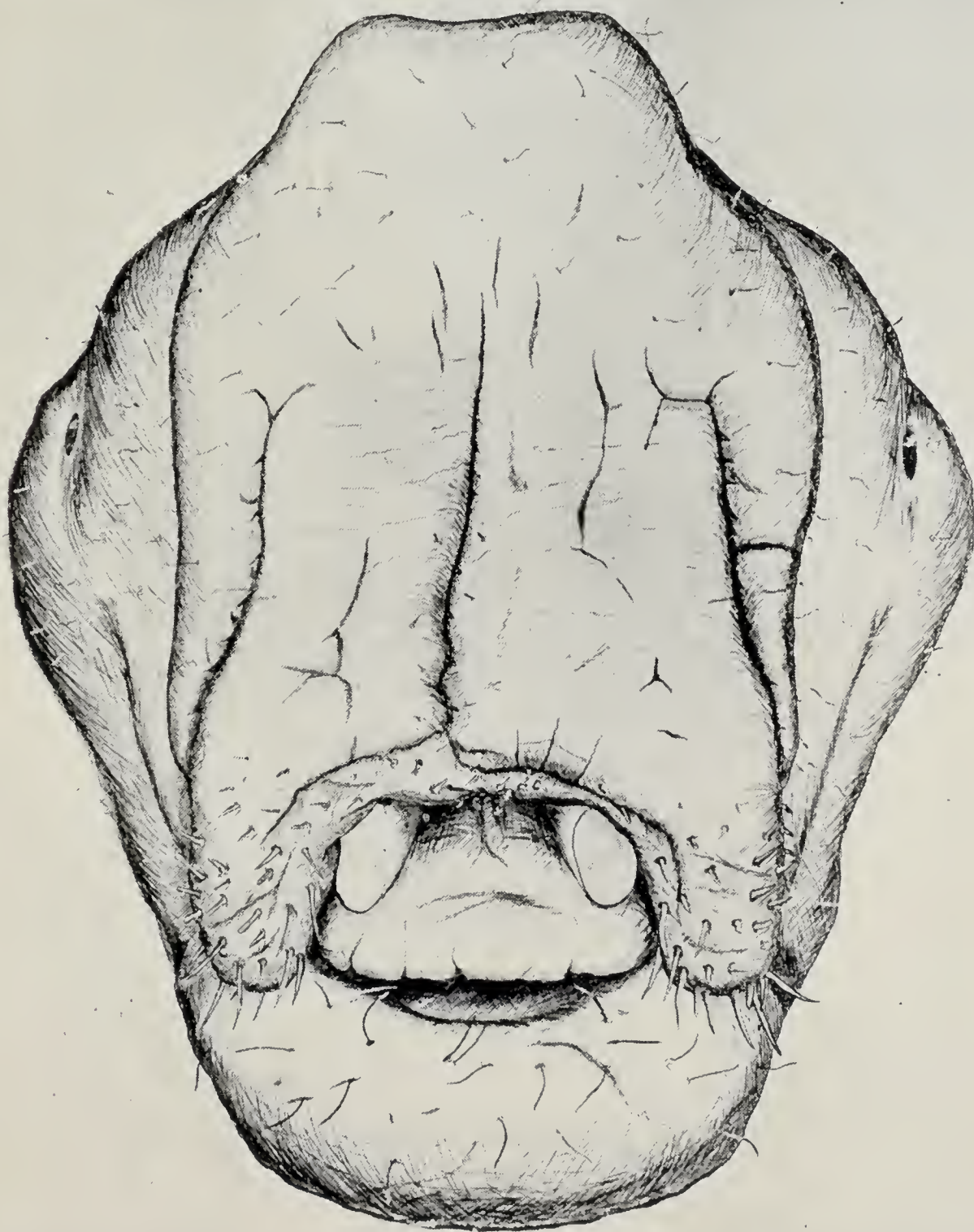




18. **Dugong**, front of face of the adult male, reduced about one-half, skeleton No. 1. See Plate XVI. The nostrils are not shown. A pair of strong, tusk-like incisor teeth, flattened from use, measured 1 inch in breadth at the worn end. The development of the premaxillæ and incisors had elongated the muzzle and raised the anterior nares to the dorsal aspect of the fore part of the head.

Queensland.

Donor—Sir Wyville Thomson.



Adult Dugong.

Family II. MANATIDÆ.

(Represented by a single genus.)

I. MANATUS. (Man.)

(Manatee, Lamantin.)

Manatus, Storr, *Prodromus, Meth. Mamm.*, 1780.

Skull with rostrum almost in the line of the axis of the base of the cranium; premaxillæ and symphysis short, only slightly bent downwards; rough surface supports horny plate. Rudimentary nails on pectoral limbs; six cervical vertebræ, the formula $C_6D_{17}L_{21}Cd_{23-25}=67$ or 69. Colour greyish. Tail horizontal, not flanged but shovel-shaped. Pectoral limbs flattened ovoids like paddles; no dorsal fin; nostrils at end of muzzle; upper lip mesially divided into two lobes. Length about 8 feet. Three species are recognised: *Manatus senegalensis* from West Africa; *M. americanus* or *australis* from South America, West Indies, Surinam; *M. inunguis* from the Amazon and Orinoco rivers.

(1) MANATUS SENEGALENSIS. (MAN. S.)

Adamson, *Hist. nat. du Sénégal*, p. 143.

Zygomatic process deep, jugal deep, upper margin of anterior nares smooth and rounded, beak and symphysis of mandible short and shallow.

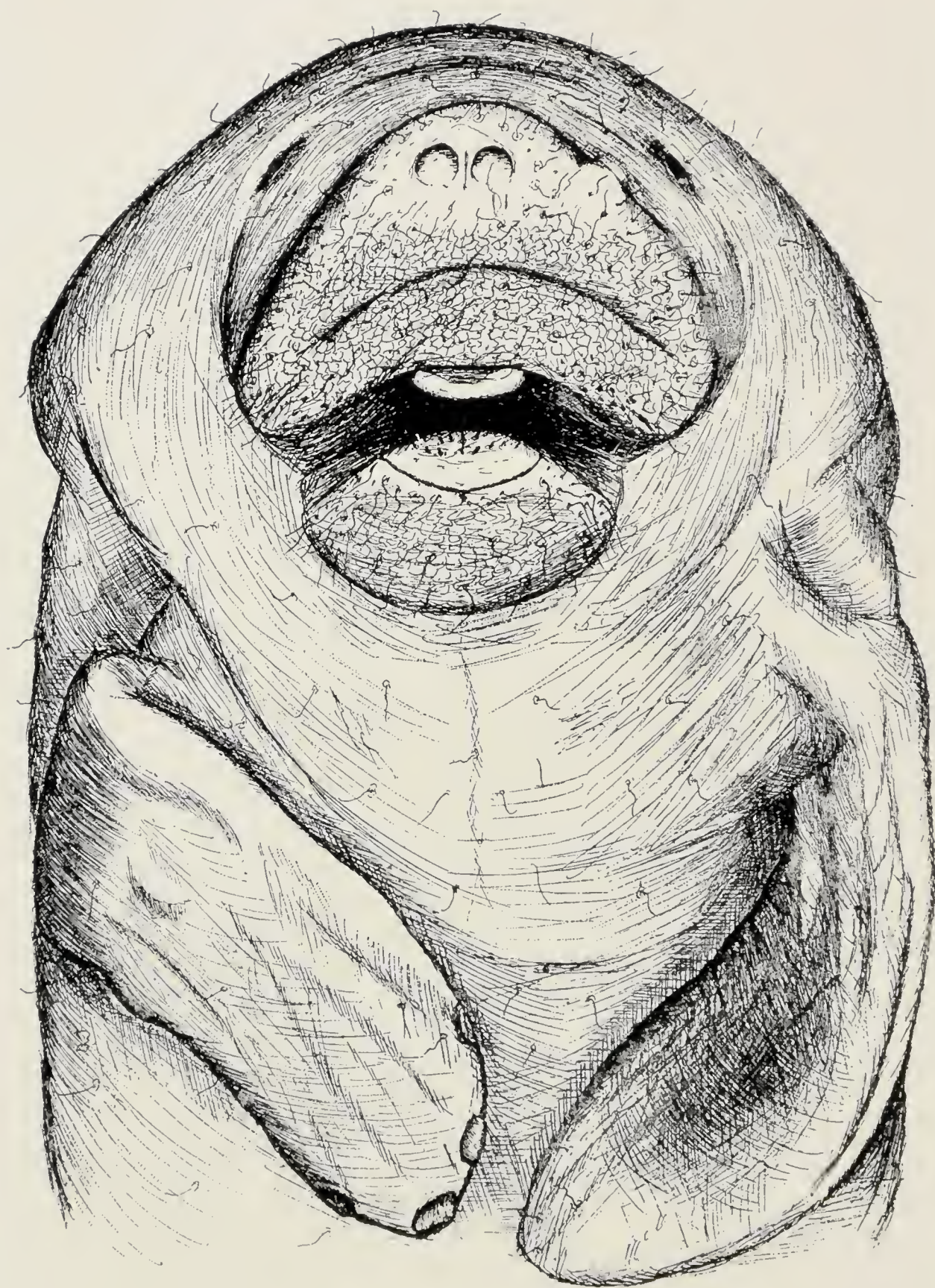
1. **Skull**, occipital bone lost; bony ring of orbital aperture not quite complete behind, long diameter $2\frac{3}{8}$ inches, vertical $1\frac{3}{4}$ inch; anterior nares large, lozenge-shaped, sagittal diameter $5\frac{1}{2}$ inches, transverse $3\frac{7}{8}$ inches, upper half of lateral border of, smooth, rounded; septal cartilage extends from frontal to symphysis, ossified and prolonged above into the mesethmoid, and completely separating the nasal chambers from each other, its surface and upper border have a honeycomb appearance. The premaxillary beak with a moderate slope downwards, width at base $1\frac{9}{16}$ inch, length of symphysis $2\frac{1}{8}$ inches; dorsal surface of frontal narrow and extends backward between the parietals, marked on the surface by a longitudinal groove. The squamoso-zygomatic process is massive, $5\frac{1}{4}$ inches long by $2\frac{1}{4}$ high: the outer surface is somewhat concave,

the upper border relatively narrow. Jugal process $2\frac{3}{4}$ inches deep, outer surface faintly concave. Palatal length of premaxillæ $2\frac{1}{5}$ inches, with a rough surface; no incisor teeth, but apparently two sockets near the tip; large anterior palatine foramen. Hard palate $3\frac{1}{4}$ inches in length from most anterior molar socket to tip of beak; condyl of mandible small, convex; symphysis with rough upper surface and no teeth. Mandible massive, length $9\frac{1}{2}$ inches, angle rectangular, coronoid not pointed, broad, projecting almost horizontally forwards. Sockets for ten molars in each superior maxilla; 1st socket empty, 2nd to 7th occupied by three-fanged teeth, the crowns of which are divided by a transverse groove into an anterior and a posterior segment; the 8th to 10th are not erupted, the 9th and 10th being deep in their bony sockets. The molars in the mandible resemble those in upper jaw. The teeth are little worn.

From Old Calabar River. Donor—Rev. Archibald Hewan.

2. **Skull.** Length in straight line $14\frac{1}{2}$ inches, over vertex 18 inches. Occipital bone ossified, basi- fused with sphenoid; temporals detachable. Orbital aperture 2 inches by $1\frac{5}{8}$ inch in diameters, bony ring imperfect; anterior nares 5 inches by $3\frac{1}{2}$ in diameter, margins sharp, somewhat rough; septal cartilage not present; premaxillary beak not hollowed for tusks, only slightly bent downwards; no incisors, a pair of circular socket-like depressions $\frac{1}{4}$ inch in diameter near free end; dorsal surface of frontal grooved anteriorly, flattened and expanded posteriorly, width $1\frac{7}{8}$ inch; squamoso-zygomatic, length $4\frac{3}{4}$ inches by $2\frac{1}{2}$ high; outer surface smooth, convex; upper border relatively broad anteriorly; jugal process $2\frac{3}{8}$ inches deep, outer surface faintly concave. Palatal part of premaxilla $2\frac{1}{4}$ inches long, surface rough; length of hard palate in front of socket of 1st molar $4\frac{1}{8}$ inches. Mandible $9\frac{1}{2}$ inches long, massive; condyl small, slightly convex; coronoid broad, not pointed, directed obliquely forward; angle rectangular, inverted; symphysis $2\frac{1}{8}$ inches; no teeth, bone rough. Upper molars, ten pairs of sockets, anterior empty and partially absorbed, 2nd to 7th occupied by teeth with crowns only slightly worn, 9th and 10th pairs not yet erupted and concealed in their bony sockets. Lower molars corresponded with upper; the bony sac which contained

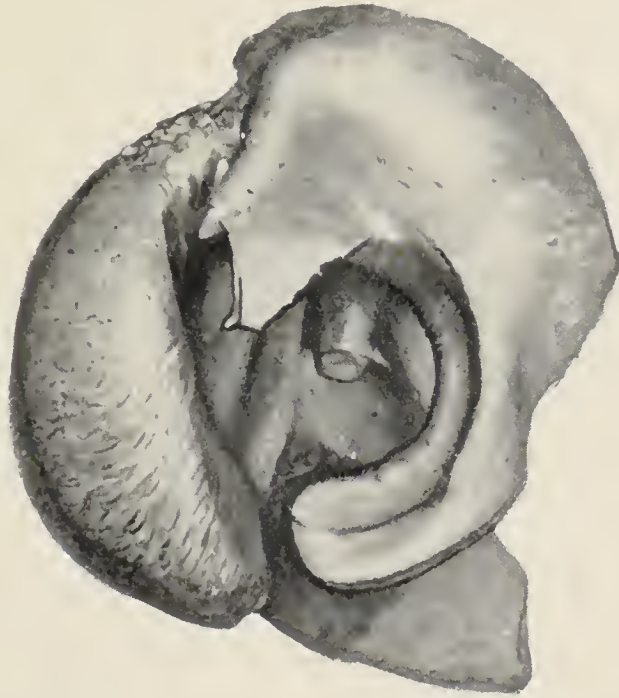




African Manatee.

the posterior was seen on the inner surface of the mandible immediately above the dental foramen. Locality of origin not known, but probably from West Africa.

3. **Tympano-periotic** bones, right, of Manatee, No. 2 in Catalogue. The tympanic is an imperfect ring, similar in form and connection to that of the Dugong, and with its broad end directed downwards, forwards, and inwards. The long diameter is 2 inches. The periotic is $2\frac{2}{10}$ inches in its longest diameter, and gives rise to an ovoid prominence which fits into the concave surface of the squamous temporal. A columnar stapes projects from the periotic into the tympanic cavity. The bones are represented in the subjoining figure, as seen on the outer surface.



4. **Fœtus** of *M. senegalensis*. Length 2 feet 10 inches from muzzle to end of tail; breadth of tail $7\frac{1}{2}$ inches; length of pectoral limb $6\frac{6}{10}$ inches. Silky hairs scattered over body, tail, and flippers. Muzzle defined above and at the sides by a crescentic fissure; $\frac{1}{4}$ inch below it are the two nostrils. Lip consists of a mid and two lateral portions. Tip of tongue movable, with a distinct frænum. Crowns of several molars have cut the gums. Lower lip thick, flexible and truncated. Nails on dorsum of four fingers, but not on pollex. Described by Turner in *Journ. Anat. and Phys.*, vol. xxviii., 1894. See Plate XVII., muzzle and pectoral limbs.

Family III. RHYTINIDÆ.

(A single genus.)

I. RHYTINA. (Rh.)

(1) RHYTINA STELLERI. (Rh. ST.)

Illiger, Prodrornus, 1811.

No teeth.

This species, the Northern Sea Cow, was discovered by Behring in the North Pacific on the shores of Behring Island. It became extinct in the eighteenth century.

No specimen in Museum.

PART III.

SUBORDER PINNIPEDIA. (PIN.)

WALRUS AND SEALS.

INTRODUCTION.

THE PINNIPEDIA are aquatic mammals, with few exceptions marine, living in the water, in which they obtain their food, either fish, molluscs, or crustacea, but resorting to the land for breeding and bringing forth their young, and at times basking on the rocks or on the ice. From their aquatic habits, the limbs are modified in shape and to some extent in structure so as to be adapted for swimming and diving. They have an extensive distribution in the great oceans, Atlantic and Pacific, and in the smaller communicating seas. Many species are found in the Arctic, and others again in the Antarctic region.

The Pinnipedia are a suborder of the Carnivora. They are appropriately classed in three well-marked families: the Trichecidæ (Odobænidæ), the Walruses; the Otariidæ, Arctocephalidæ, the Eared Seals; the Phocidæ, the Hair Seals, without a pinna to the ear.

I may refer to my Report on the Seals collected during the voyage of the *Challenger* (Report, part lxxviii., 1887) for a more detailed description of the anatomical characters of the skeletons and skulls, not only of the specimens collected by the naturalists on the *Challenger*, but of the Pinnipedia which frequent the North Atlantic, Arctic and Antarctic Oceans, examples of which are in the Museum.

The TRICHECIDÆ amongst existing mammals consist of only a single genus, *Trichecus* (Odobænus). Authorities generally consider that the genus contains only the species *Trichechus rosmarus*. Mr J. A. Allen, however, contends that the Walrus of the North Pacific differs from that of the North Atlantic, and he applies to the former the specific name *T. obesus*. It seems doubtful if the anatomical differences which he has noted in the comparison of skulls from the North Pacific and North Atlantic should be regarded as having specific distinction. I have found, in the study of the crania in the Museum from the North Atlantic, differences not unlike those to which Allen has attached specific importance, obviously due to the stage of development of the canine tusks, their length, thickness, and curvature, which modify the projection and breadth of the face, and are sexual or individual variations, and not of specific importance. The Walrus is an Arctic animal, but stragglers have been captured in Orkney and the Hebrides.

THE OTARIIDÆ.—So many diversities are to be found in the writings of naturalists regarding this family that it is difficult to construct a classification which can be regarded as conclusive. Dr J. E. Gray made nine genera and eighteen species of Eared Seals, Dr Peters three genera and thirteen species. Mr Allen, founding upon differences in the character of the pelage, proposed two subfamilies, Tricophocacæ and Ouliphocacæ, which correspond with the older division Hair Seals or Sea Lions, and Fur Seals or Sea Bears. Sir Wm. Flower, again, included all the Eared Seals in the single genus Otaria, and regarded the Sea Lions and Sea Bears as merely species of that genus. It is indeed questionable if a sharp line of demarcation separates the pelage of the Sea Lions from that of the Sea Bears, though in the latter a thick coat of under-fur constitutes the important structural character which gives to these seals their special economic value. Differences undoubtedly exist in the cranial characters in different species of Eared Seals, which justify a certain amount of subdivision of the old genus Otaria. Along with Peters and Allen, I restrict the name Otaria to the Sea Lion of the South Atlantic and South Pacific. The species of Sea Bears, again, may be arranged, as was done by Peters, in two genera, Arctocephalus and Eumetopias, though it should be admitted that Peters gave too brief a specification of their generic difference, and some zoologists prefer to regard this division as unnecessary, and combine all the species in the genus Arctocephalus.

THE PHOCIDÆ.—The Phocidæ or True Seals are distinguished by the absence of the pinna of the ear, by the hind limbs not being used for support and progression, but being directed backwards at the sides of the tail, by the palms and soles being hairy, and by the body being covered by short, stiff hairs without under-fur. They are the Hair Seals proper. They have a wide distribution. Several species frequent the North Atlantic as far north as the Arctic Ocean; others are found in the Southern and Antarctic Oceans, and one species, *Monachus*, seems to be restricted to the Mediterranean; others occur in the Caspian and Aral Seas and in Lake Baikal. Two species frequent the coast of Scotland, *Phoca vitulina* and *Halichorurus grypus*, and occasionally a specimen of an Arctic seal is met with. Isolated examples of the Hooded Seal, *Cystophora cristata*, have been seen in the Orkneys, and in 1872 one was caught in St Andrews Bay. The Harp Seal, *Phoca grænlundica*, has been seen in Shetland, and in 1875 I recorded the capture in the preceding year of a specimen in Morecambe Bay. The Arctic seals are very gregarious, and in the spring are slaughtered in enormous numbers for the oil and skins.

The family Phocidæ is divided into three subfamilies: Phocinæ, Ogmorhininæ, and Cystophorinæ. The Museum contains upwards of one hundred and forty specimens.

SPECIMENS OF PINNIPEDIA.

Family I. TRICHECIDÆ.

No external ear; no scrotum; upper canines grow into long, powerful tusks; the other teeth with single roots relatively small and simple. Skull with an alisphenoid canal. Hind feet, toes can be turned forwards. Inner wall of orbit complete, that of zygomatic fossa defective. Anterior nares terminal; astragalus without calcaneal process.

I. TRICHECHUS. (Tr.)

Trichechus, *Linnaeus, Syst. Naturæ*, 1735.

A bulky animal, the adult male being about 10 feet long; skin with short hairs, yellowish brown, darker on venter; soles of manus and pes bare and rough; head rounded, muzzle short, broad, with stiff whiskers; eyes small; tail short; dorsum of digits with nails; mammæ four.

(1) TRICHECHUS ROSMAREUS. (Tr. R.) (Auctorum.)

(Walrus, Morse, Sea Horse.)

Hard palate truncated, reaching hamular pterygoids and in line with anterior border of glenoid fossa; zygomatic arch not bulging; orbits relatively small. Tympanics not swollen, rough on inferior surface.

Permanent dentition: in. $\frac{1}{0} \frac{1}{0}$, c. $\frac{1}{1} \frac{1}{1}$, post-canine

or molars $\frac{3}{3} \frac{3}{3} = 18$. Milk dentition: in. $\frac{3}{3} \frac{3}{3}$, c. $\frac{1}{1} \frac{1}{1}$,

p.c. $\frac{5}{4} \frac{5}{4} = 34$. Vertebral formula $C_7D_{14}L_6S_4Cd_{12} = 43$.

Scapula, præspinous larger than postspinous fossa. Humerus without a supracondyloid foramen; crest of ilium in front of base of sacrum; femur with rudimentary small trochanter. The last and the penultimate upper molars and the last lower molar sometimes absent. North Atlantic and North Pacific.

1. **Skeleton**, adult, articulated. Length 9 feet 4 inches. Skull, length in straight line 15 inches, over vertex 20 inches. Spine, length 8 feet 1 inch, formula $C_7D_{14}L_6S_3Cd_7=37$; the terminal vertebræ have not been preserved. Ribs, 14 pairs, the last of which, 12 inches long, is apparently a floating rib. Sternum is 2 feet 4 inches long, and $2\frac{3}{8}$ inches broad about the middle; it consists of 9 segments, the last of which is tipped with cartilage. The 1st pair of costal cartilages articulate near anterior end, the 2nd to 9th at the junction of segments, the 10th to 14th do not reach the sternum. Mandible $10\frac{1}{4}$ inches long. Tusk, length of protruded part 16 inches, girth at alveolus 6 inches. Scapula, glenoido-vertebral diameter $14\frac{3}{4}$ inches; spine low, acromion short, coracoid feeble, præspinous fossa much larger than postspinous. Humerus $13\frac{3}{4}$ inches long; radius $10\frac{1}{2}$ inches; ulna with long olecranon $13\frac{1}{2}$ inches. Carpus; radiale and intermedium fused together, ulnare, pisiform, four distal carpalia. Digits five, pollex MPh_2 , the others each MPh_3 . Os innominatum from iliac crest to ischial tuber $15\frac{1}{2}$ inches. Femur, head to inner condyl 10 inches; tibia, length $13\frac{1}{2}$ inches; fibula $13\frac{1}{4}$ inches. Tarsus the customary seven bones; digits five, hallux MPh_2 , the others MPh_3 .
2. **Skeleton**, length 8 feet 5 inches. Skull, length in straight line 13 inches, over vertex 17 inches. Spine 7 feet $3\frac{1}{2}$ inches, formula $C_7D_{15}L_5S_4Cd_8=39$. Two or perhaps three caudal vertebræ missing; the fifteenth rib on each side is only $2\frac{3}{4}$ inches long, free and floating; its presence increases the number of dorsal vertebræ and diminishes that of the lumbar. Sternum consists of nine segments and articulates with the cartilages of nine pairs of ribs. Manus and pes imperfect.
3. **Skull**, with tusks and mandible: length 15 inches, over vertex $19\frac{1}{2}$ inches. Tusk, left, length $11\frac{1}{2}$ inches, right $9\frac{1}{2}$ inches, girth $6\frac{1}{8}$ inches left. Mandible, length $10\frac{1}{2}$ inches. Dentition: c. $\frac{1}{0} \frac{1}{0}$, p.c. $\frac{3}{4} \frac{3}{4}$.

4. **Skull**, with mandible; length, condylo-premaxillary, in straight line 15 inches, over curve 20 inches. Tusk, length of, 12 inches, girth $6\frac{1}{2}$ inches. Length of mandible $10\frac{3}{4}$ inches. Dentition: c. $\frac{1}{0} \frac{1}{0}$, p.c. $\frac{4}{4} \frac{4}{4}$.
Monro Collection.
5. **Skull**, with mandible; length, condyls absent, in straight line 14 inches, approximately. Tusk $8\frac{3}{4}$ inches long, girth $5\frac{1}{4}$ inches. Mandible, length 8 inches. Dentition: $\frac{1}{0} \frac{1}{0}$, p.c. $\frac{4}{3} \frac{4}{3}$.
6. **Skull**, with mandible; length in straight line $13\frac{1}{4}$ inches, over vertex 19 inches. Tusk, length 10 inches, girth at socket $5\frac{5}{8}$ inches. Mandible, length $8\frac{1}{2}$ inches, Dentition: c. $\frac{1}{0} \frac{1}{0}$, p.c. $\frac{4}{4} \frac{4}{4}$.
7. **Skull**, with mandible; length in straight line $12\frac{1}{2}$ inches, over vertex 18 inches. Tusk $15\frac{1}{2}$ inches, girth $5\frac{1}{2}$ inches. Mandible $9\frac{1}{4}$ inches long. Dentition: c. $\frac{1}{0} \frac{1}{0}$, p.c. $\frac{4}{4} \frac{4}{4}$.
8. **Skull**, with mandible; length in straight line $16\frac{3}{4}$ inches, over vertex 22 inches. Tusk, length 13 inches, girth 6 inches, laterally compressed. Mandible, length 12 inches. Dentition: c. $\frac{1}{0} \frac{1}{0}$, p.c. $\frac{4}{4} \frac{4}{4}$.
9. **Skull**, without mandible, adult male.
Donor—Sir Wm. Turner.
10. **Skull**, much broken, with mandible, immature. Occipital bone wanting. Tusk, length $7\frac{3}{4}$ inches, girth $4\frac{1}{2}$ inches, laterally compressed. Mandible $9\frac{3}{4}$ inches. Dentition: c. $\frac{1}{0} \frac{1}{0}$, p.c. $\frac{4}{4} \frac{4}{4}$.
11. **Skull**, fore part of, with tusks and broken mandible, immature. Tusk, length 2 inches, girth $2\frac{1}{8}$ inches. Dentition: in. $\frac{0}{0} \frac{0}{0}$, c. $\frac{1}{0} \frac{1}{0}$, p.c. $\frac{4}{4} \frac{4}{4}$.
12. **Skull**, immature, with mandible; length $12\frac{1}{2}$ inches, over vertex 18 inches. Tusk, length 7 inches, girth $3\frac{1}{2}$ inches, laterally compressed. Mandible, length $8\frac{3}{4}$ inches. Dentition: c. $\frac{1}{0} \frac{1}{0}$, p.c. $\frac{4}{4} \frac{4}{4}$.

13. **Maxillæ**, premaxillæ, and tusks, young. Tusk, length $4\frac{1}{4}$ inches, girth $2\frac{3}{4}$ inches, laterally compressed. On each side two simple post-canines, but on the left side a styliform tooth, $\frac{3}{4}$ inch long, protruded on the inner side of the canine alveolus. In the left premaxilla is an empty socket, but not in the right.

14. **Skull** of a foetus, artificially articulated. Dentition:

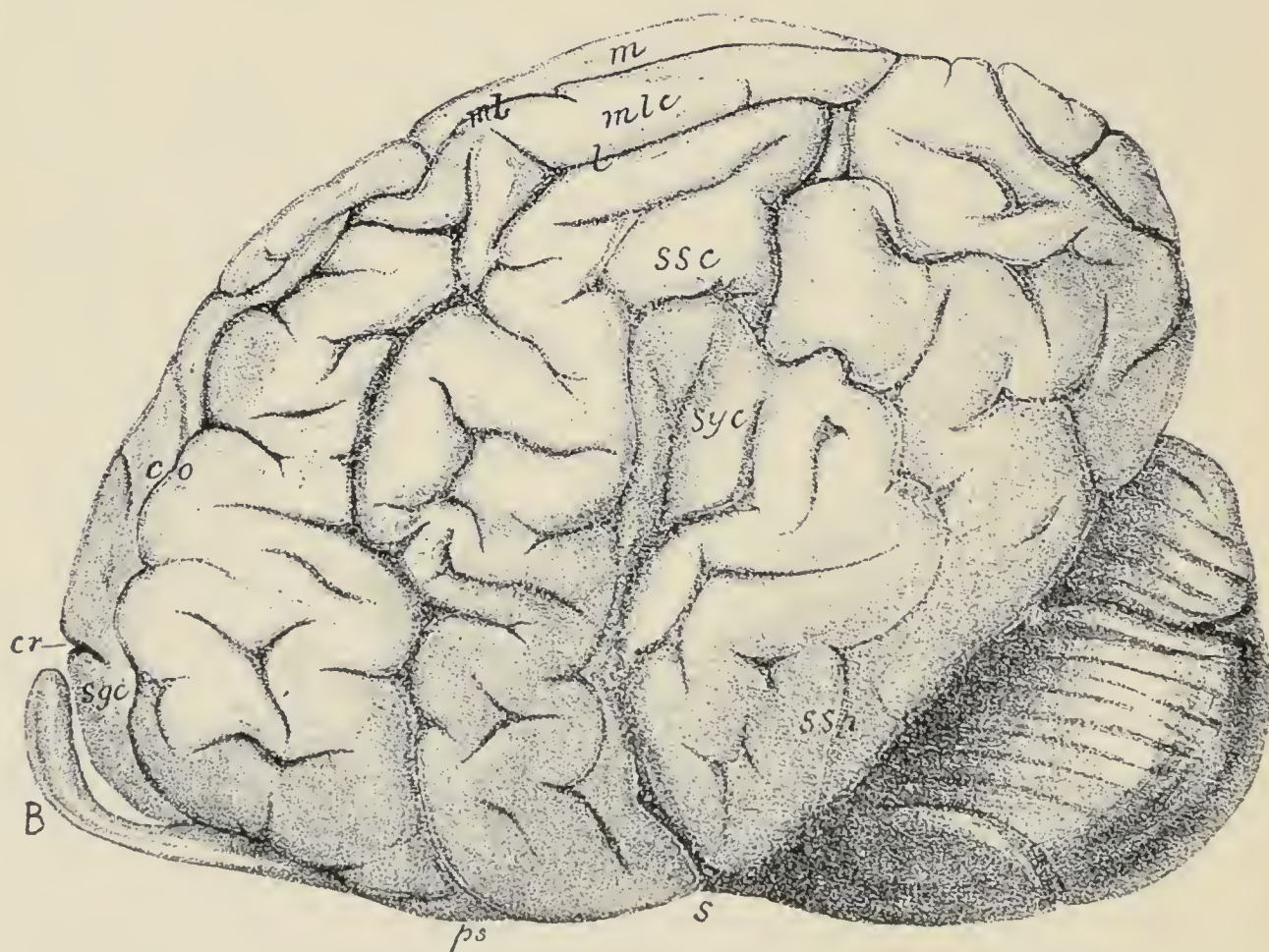
in. $\frac{1}{0} \frac{1}{0}$, c. $\frac{1}{0} \frac{1}{0}$, p.c. $\frac{3}{5} \frac{3}{5}$.

15. **Tusk**, length 11 inches.

Purchased—Woodcock Collection.

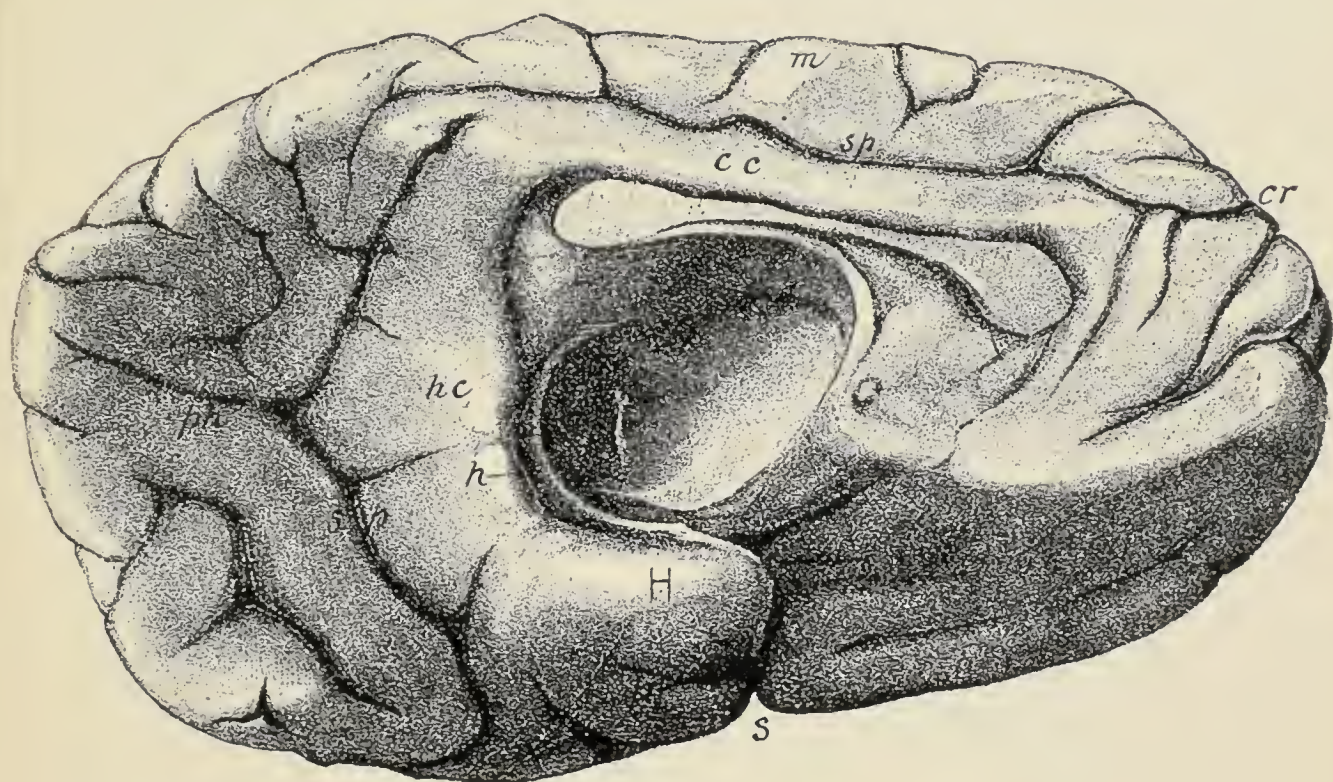
16. **Cranial** cavity, cast of, from a skull in the Museum of the Royal College of Surgeons, England, showing the general form of the brain. Purchased.

17. **Brain** of Walrus, dissected. A specimen presented by Dr Charles Moon. The figure below is of the cranial surface of the left hemisphere.



B, olfactory bulb; s, Sylvian fissure; ps, pre-Sylvian fissure; ssp, back of supra-Sylvian, cr, crucial, co, coronal, ml, medilateral fissures; mle, medialateral, ssc, supra-Sylvian, syc, Sylvian, sgc, sigmoid, m, marginal convolutions.

18. **Brain** of Walrus. A specimen presented by Mr C. Edward Smith. The figure shows the mesial surface of the left hemisphere. The brain of this species has been described and figured by Turner in *Challenger Report* and in *Journ. Anat. and Phys.*, vol. xxv., 1891.



H, lobus hippocampi; S, Sylvian fissure; *sp*, splenial, *ph*, postero-horizontal, *h*, hippocampal, *cr*, crucial fissures; *m*, marginal, *cc*, callosal, *hc*, hippocampal convolutions.

19. **Hyoid** apparatus, body, antero-posterior diameter $2\frac{1}{4}$ inches, transverse $2\frac{3}{4}$ inches. Thyro-hyal, length $3\frac{1}{4}$ inches; stylo-hyal $4\frac{1}{4}$ inches.

20. **Os Penis**, $21\frac{1}{2}$ inches long; girth at base $8\frac{1}{4}$ inches.
Monro Collection.

21. **Os Penis**, four specimens mounted on stand.
Donor—Capt. Adams, s.s. "Maude," Dundee.

22. **Os Penis** which had been broken during life and then repaired.
September 1869. Donor—Captain Adams, Dundee.

23. **Whisker**. Thick horn-like bristle $2\frac{1}{2}$ inches long, from the muzzle of a Walrus, dissected to show the root in its follicle.

Family II. OTARIIDÆ.

Ear with a small pointed pinna; testes in a scrotum. Canines large but not developed into tusks. Hind feet supporting the body, with toes turned forwards, can be used in terrestrial locomotion; palms and soles not hairy; nails on dorsum of toes. Skull with orbital processes and an alisphenoid canal: inner wall of orbit defective; anterior nares not quite terminal; astragalus without a calcaneal process. The specimens are described in the *Challenger Reports*, part lxviii.

I. OTARIA. (Ot.)

Otaria, Péron, *Voyage aux terres austr.*, ii. 1816.

Hair stiff and without under fur. Hard palate truncated, elongated, almost reaching the hamular pterygoids, and in transverse line with anterior border of glenoid fossa; borders of palate raised, its surface deeply concave. Premaxilla articulates with outer border of nasal. Posterior nares contracted.

(1) OTARIA JUBATA. (OT. J.)

(Southern Sea Lion.)

Phoca jubata, Forster, *Descript. anim.*, 1775.

Otaria leonina, Gray, *British Mus. Cat.*, 1866.

Length about 7 feet. Colour of hair dark brown when skin is wet, lighter brown when dry. Last upper molar immediately behind posterior border of zygomatic root of maxilla. Mandible with massive subcondyloid process inflected inwards; lower border of body everted. Vertebral formula $C_7D_{15}L_5S_4Cd_8 = 39$. South Atlantic and South Pacific.

1. **Skull**, with mandible, adult male. Length in straight line $14\frac{1}{2}$ inches, over vertex 20 inches; breadth $9\frac{1}{4}$ inches. Hard palate $9\frac{1}{4}$ inches long, surface very deep. Premaxilla fused with superior maxilla. Mandible 11 inches long. Dentition: in. $\frac{3}{2} \frac{3}{2}$, c. $\frac{1}{1} \frac{1}{1}$, post-c. $\frac{6}{5} \frac{6}{5}$.

West Falkland Islands.

Challenger Collection.

2. **Skull**, adult male, no mandible. Premaxilla not fused with superior maxilla. Length $14\frac{1}{4}$, over vertex 19

inches; breadth $8\frac{7}{8}$ inches. Surface of hard palate deeply concave, length 9 inches. Dentition: in. $\begin{smallmatrix} 3 & 3 \\ - & - \end{smallmatrix}$,
c. $\begin{smallmatrix} 1 & 1 \\ - & - \end{smallmatrix}$, p.c. $\begin{smallmatrix} 6 & 6 \\ - & - \end{smallmatrix}$.

Straits of Magellan, Laredo Bay.

Donor—Dr R. O. Cunningham.

3. **Skull**, adult female, no mandible. Length in straight line $9\frac{1}{2}$ inches, over vertex $13\frac{1}{4}$ inches; breadth 6 inches. Surface of hard palate concave, length $5\frac{3}{4}$ inches. Dentition: in. $\begin{smallmatrix} 3 & 3 \\ - & - \end{smallmatrix}$, c. $\begin{smallmatrix} 1 & 1 \\ - & - \end{smallmatrix}$, p.c. $\begin{smallmatrix} 6 & 6 \\ - & - \end{smallmatrix}$.

Maldonado, River Plate. Donor—Dr R. O. Cunningham.

4. **Skull**, with mandible, very young. Length $6\frac{1}{4}$ inches, breadth $3\frac{3}{4}$ inches; length of palate 3 inches; length of mandible 4 inches. Dentition: post-canines $\begin{smallmatrix} 6 & 6 \\ 5 & 5 \end{smallmatrix}$, erupted in lower jaw, about to pierce gum in upper. Stanley, Falkland Islands. Challenger Collection.

5. **Skull**, much broken, female. Length 10 inches, over vertex 12 inches. Hard palate, length $5\frac{1}{2}$ inches: no mandible. Dentition: in. $\begin{smallmatrix} 3 & 3 \\ - & - \end{smallmatrix}$, c. $\begin{smallmatrix} 1 & 1 \\ - & - \end{smallmatrix}$, p.c. $\begin{smallmatrix} 6 & 6 \\ - & - \end{smallmatrix}$.

Chincha Islands.

McBain Collection.

6. **Vertebra**, atlas, and a digit from No. 1. Atlas, transverse diameter $6\frac{1}{2}$ inches. Single digit with three phalanges. West Falkland Islands. Challenger Collection.

II. EUMETOPIAS. (Eu.)

Eumetopias, *Gill, Proc. Essex Institute*, v., 1866.

This genus was suggested by Gill, and distinguished from Otaria by the hard palate ending well in front of the pterygoid processes, the hinder border being usually scooped or emarginate, and the surface being flat or nearly so. The molars are $\begin{smallmatrix} 5 & 5 \\ 5 & 5 \end{smallmatrix}$. Gill regarded the Alaskan Sea Lion described by Steller as the only species of Eumetopias, whilst others associate with this genus the Californian Sea Lion, the Grey Sea Lion, and Hooker's Sea Lion. It should be stated that, if Eumetopias is limited to

Steller's Sea Lion, a more precise definition of the characters of the genus can be given than if the other species are included.

(1) EUMETOPIAS STELLERI. (EU. ST.)

(The Northern or Steller's Sea Lion.)

Otaria stelleri, Lesson, *Dict. Class. Hist. Nat.*, xiii., 1828.

Length 10 to 13 feet in the males, 8 to 9 feet in the females. Colour varies with age, light brown or ochre in adult, chestnut brown in young. Deeper than the outer coat of coarse hair is a finer coat, so short as to be easily overlooked. Fifth pair of molars separated by a considerable interval from the fourth pair. North Pacific, from Behring Strait to California and Japan.

1. **Skull**, adult male. Length $14\frac{1}{2}$ inches in straight line, over vertex 19 inches; breadth $8\frac{1}{2}$ inches. Palate truncated, moderately concave, $7\frac{1}{4}$ inches, but not reaching the pterygoids. Mandible $11\frac{1}{2}$ inches long. Dentition: in. $\frac{3}{2} \frac{3}{2}$, c. $\frac{1}{1} \frac{1}{1}$, p.c. $\frac{5}{5} \frac{5}{5}$; in the upper jaw is a big gap between the fourth and fifth post-canine teeth.

St Paul's Island, Alaska.

Donor—Smithsonian Institute.

(2) EUMETOPIAS CALIFORNIANUS. (EU. CA.)

(Californian Sea Lion, Gillespie's Seal.)

Otaria californianus, Lesson, *Dict. Class. Hist. Nat.*, xiii., 1828.

Otaria gillespii, M'Bain, *Proc. Roy. Phys. Soc. Edin.*, i., 1858.

Zalophus gillespii, Gill, *Proc. Essex Inst.*, v., 1866.

Zalophus californianus, Allen, *North American Pinnipeds*, 1880.

Length of male 7 to 8 feet, of female 5 to 6 feet; hair short, stiff; colour varies from brownish yellow to reddish or blackish brown; high and long sagittal crest. Frequents the coast of California. Type skull described by Dr M'Bain is in the University Anatomical Museum. Gill founded the genus *Zalophus* on M'Bain's description.

1. **Skull**, adult male; prominent sagittal crest on dorsum cranii; facial part more slender, narrower and elongated, and anterior nares more oblique than in

Arctocephalus. Length 11 inches, over vertex $14\frac{1}{2}$; interzygomatic breadth $6\frac{1}{2}$ inches; cranial $4\frac{3}{8}$ inches. Hard palate almost flat, posterior border crescentic, well in front of the pterygoids. Mandible $8\frac{1}{4}$ inches long. Dentition, post-canine $\frac{5}{5} \frac{5}{5}$; not a big gap between the last two teeth. Type specimen from M'Bain Collection figured below.



(3) EUMETOPIAS CINEREA. (EU. CIN.)

(Grey Sea Lion of New Zealand and Australia.)

Otaria cinerea, Péron, *op. cit.*; also Peters.

Zalophus lobatus, Gill, *ut supra*.

Length about 6 feet. Colour, males blackish grey, females silvery grey. Pelage soft with under fur.

Toes almost equal in length; toe flaps project considerably beyond the nail. Molars $\frac{6}{5} \frac{6}{5}$.

1. **Skeleton** of adult male. Length of spine along curve 6 feet $1\frac{1}{2}$ inch, of skull in straight line $11\frac{3}{4}$ inches; total length of skeleton 7 feet $1\frac{1}{4}$ inch. Vertebral formula $C_7D_{15}L_5S_2Cd_9=38$; the last caudal is probably missing. Ribs, fifteen pairs. Sternum, nine segments. Scapula falcate, length between angles 12 inches, glenoido-vertebral diameter $10\frac{1}{2}$ inches; præspinous fossa about three times larger than postspinous, acromion rudimentary, no coracoid. Humerus $9\frac{1}{4}$ inches long, no supracondyloid foramen. Radius 8 inches

long; ulna 10 inches, with large olecranon. Manus pentadactylous, digits diminish in length from hallux to minimus; carpus with radiale and intermedium fused, ulnare, four distal carpalia. Pelvic bone 10 inches long, crest directed forwards and outwards; femur 5 inches long; tibia and fibula fused together at upper end, tibia 10 inches long, fibula $9\frac{1}{2}$ inches. Pes, five digits almost equal in length, tarsalia eight bones, the eighth being an entoscaphoid situated at inner border and articulating with scaphoid and ento-cuneiform. The entoscaphoid represents the tubercle of the human scaphoid, which sometimes persists as a separate bone. The hyoid apparatus consists of basi-hyoid, a pair of cerato-hyoids, a pair of thyro-hyoids, epi-hyoids, and stylo-hyoids; the elements of the hyoid proper are united by movable joints, the others by intermediate cartilages. Skull, zygomatic breadth 7 inches, cranial 4 inches; sagittal and occipital crests moderate; face elongated in front of the cranium, constricted between cranium and the post-orbital process, being pinched in laterally; nasals more elongated than in Gillespie's Seal; hard palate 5 inches long, anterior part concave, posterior flattened, lateral borders almost parallel; posterior border scooped out, well in front of the hamular pterygoids; tympanics roughened. Mandible $8\frac{1}{2}$ inches long, with a broad coronoid process. Dentition, post-canine $\frac{6}{5} \frac{6}{5}$, with cingulum, large central cusp, small anterior and posterior cusps, teeth set obliquely in sockets. Skull described by Turner in *Challenger Reports*, part lxviii., 1887.

Victoria, Australia.

Purchased.

2. **Skull** of a young female. Length 8 inches, over vertex $10\frac{1}{2}$ inches; breadth $4\frac{1}{2}$ inches: palate $3\frac{1}{2}$ inches long, a little concave, not reaching pterygoids. Mandible $5\frac{1}{4}$ inches long. Dentition, post-canine $\frac{6}{5} \frac{6}{5}$.

Victoria.

Purchased.

(4) EUMETOPIAS HOOKERI. (EU. H.)

(Hooker's or Auckland Island Hair Seal.)

Arctocephalus hookeri, Gray, *Voyage Erebus and Terror*, 1844.
Otaria hookeri, Peters, *Monatsb. Preuss. Akad. d. Wissen.*,
 Berlin, 1867.

The presence of a large species of Eared Hair Seal on the Auckland Islands was established by Mr J. W. Clark (*P. Z. S.*, 1873), who identified it with the skulls collected by Sir J. C. Ross in his voyage to the Antarctic, which were named *Arctocephalus hookeri* by Dr Gray. The skull is distinguished by its great length in relation to both the zygomatic and cranial breadth. The hard palate is almost truncated, but ends behind about opposite the middle of the zygomatic arch and well in front of the hamular pterygoids.

No specimen in Museum.

III. ARCTOCEPHALUS. (Arc.)

Arctocephalus, *F. Cuvier*, *Mém. du Museum*, xi., 1824; and *Dict. d. Sc. Nat.*, xxxix., 1827.

Thick under-fur; ears relatively long; facial part of skull short, broad, with nares almost vertical in one species, in others elongated and pointed, with nares oblique; hard palate ends well in front of the hamular pterygoids, posterior border deeply concave; post-canines $\frac{6}{5} \frac{6}{5}$, large central cusp, small anterior and posterior cusp not always present. External characters, skeletons, and skulls of several species of Fur Seals were described by Sir W. Turner in *Challenger Reports*, part lxxviii., 1887.

(1) ARCTOCEPHALUS URSINUS. (ARC. UR.)

(Fur Seal of North Pacific, the Alaskan Fur Seal.)

Ursus marinus, *Steller*, *Nov. Comm. Acad. Petrop.*, ii., 1751.

Phoca ursina, *Linnaeus*, *Syst. Nat.*, l., 1758.

Callorhinus ursinus, *Gray*, *Proc Zool. Soc. London*, 1859; and *Allen*, *North American Pinnipeds*, 1880.

Anterior nares almost terminal, nearly vertical; front of face short, truncated, relatively broad; short nasals sloping downwards. These appearances are peculiar, and induced Dr Gray to make this species a new genus, *CALLORHINUS*, with which Mr Allen coincides. Teeth: molars $\frac{6}{5} \frac{6}{5}$, small, one large cusp; lower molars in addition a small anterior cusp, no diastema; 5th upper molar in line with posterior

edge of zygoma. Hard palate narrowed behind, hinder border concave; mandible with inverted subcondyloid process. Length, old males 7 to 8 feet, females about 4 feet. Manus long, narrow, naked; nails rudimentary. Pes with toe-flaps very long; nails rudimentary in outer toes, strong in middle toes.

1. **Skeleton** of well-grown animal, not articulated, vertebral plates not ossified to bodies; epiphyses of long bones not fused with shafts. Vertebral formula, $C_7D_{15}L_5S_3Cd_8$ to $_{10}$ = 38 to 40. Ribs, fifteen pairs. Sternum, nine segments, 23 inches long; upper segment $3\frac{7}{8}$ inches; xiphisternum with cartilaginous tip $5\frac{1}{2}$ inches; nine pairs of costal cartilages articulated at junction of segments, two pairs between 8th and 9th segments. Scapula broad, prespinous much larger than postspinous fossa, acromion rudimentary, coracoid a tubercle, lower border falciform. Humerus without supracondyloid foramen. Pelvic bones, iliac crest not inverted nor everted; ilium articulates with 1st and 2nd sacral vertebræ. Skull, length 9 inches, over vertex 12 inches; zygomatic breadth $5\frac{1}{2}$ inches; cranial breadth $3\frac{3}{4}$ inches; pair of occipital crests. Hard palate scooped out behind, from middle of posterior border to hamular pterygoid $1\frac{3}{8}$ inch, from incisors to posterior border $3\frac{3}{8}$ inches; surface shallow. Mandible $6\frac{1}{4}$ inches long. Dentition: $\frac{3}{2} \frac{3}{2}$, c. $\frac{1}{1} \frac{1}{1}$, p.c. $\frac{6}{5} \frac{6}{5}$; no diastema: each post-canine tooth with large cusp, lower molars also with small supplementary cusps.

St Paul's Island, Alaska.

Donor—The Smithsonian Institute, Washington.

(2) ARCTOCEPHALUS AUSTRALIS. (ARC. AU.)

(South American Fur Seal.)

Phoca australis, *Zimmermann*, *Geog. Geschichte*, iii., 1783.

Facial part narrow, slender, elongated; nasal bones horizontal; sagittal crest moderate; post-canines with large cusp, small anterior cusp and cingulum, the last two with small posterior cusp; mandible.

1. **Skeleton**, imperfect, of a male *A. australis*, No. 3 in *Challenger Report*, from Messier Channel. Seven cervical vertebræ, atlas greatest width $4\frac{1}{2}$ inches. Ribs and sternum absent. Scapula, length between

angles 10 inches, glenoido-vertebral 8 inches, moderately falcate, prespinous more than twice as large as post-spinous fossa, acromion rudimentary, no coracoid. Humerus, length $7\frac{1}{4}$ inches; no supracondyloid foramen; radius $7\frac{1}{8}$ inches; ulna $8\frac{7}{8}$ inches, with large olecranon. Manus with seven carpalia, pollex longest, minimus shortest. Pelvis, length $8\frac{1}{4}$ inches; iliac crest $1\frac{1}{4}$ inch in front of base of sacrum; femur $4\frac{1}{4}$ inches long, tibia $8\frac{7}{8}$ inches, fibula $8\frac{1}{8}$ inches. Tarsalia, eight bones, the eighth being an entoscaphoid articulating with the inner sides of the scaphoid and ento-cuneiform bones. Digits almost equal in length. Skull, length $9\frac{1}{8}$ inches, face much broken; breadth, zygomatic $5\frac{3}{4}$ inches, cranial $3\frac{7}{8}$ inches. Hard palate deeply scooped behind; length 4 inches; alveolar borders almost parallel. Mandible $6\frac{3}{8}$ inches long.

Challenger Collection.

2. **Skull**, adult, no mandible, probably female. Length 8 inches, over vertex $10\frac{3}{4}$ inches; zygomatic breadth $4\frac{5}{8}$ inches. Palate moderately concave on surface; length from truncated border to pterygoid 1 inch; length of palate $3\frac{3}{8}$ inches. Dentition: $\begin{smallmatrix} 3 & 3 & 1 & 1 & 6 & 6 \\ - & - & - & - & - & - \end{smallmatrix}$; teeth in place, large cusp with small supplementary cusps, no diastema.

Messier Channel.

Challenger Collection.

3. **Skull**, male, aged, left zygoma wanting, no mandible. Length, $9\frac{1}{2}$ inches, over vertex $12\frac{1}{2}$ inches. Palate shallow, scooped out, from mid-posterior border suture to pterygoid $1\frac{1}{8}$ inch; length of palate $4\frac{1}{8}$ inches. Dentition: in. $\begin{smallmatrix} 3 & 3 & 1 & 1 & 6 & 6 \\ - & - & - & - & - & - \end{smallmatrix}$, c. $\begin{smallmatrix} 3 & 3 & 1 & 1 & 6 & 6 \\ - & - & - & - & - & - \end{smallmatrix}$; post-canines without diastema; teeth broken or lost.

Tuesday Bay, Desolation Island, Straits of Magellan.

Donor—Dr R. O. Cunningham.

4. **Skull**, male, much damaged, aged, no mandible. Length $9\frac{1}{2}$ inches; zygomatic breadth $5\frac{3}{4}$ inches. Palate shallow, scooped out behind; distance to pterygoid 1 inch; length $4\frac{1}{4}$ inches. Dentition: in. $\begin{smallmatrix} 3 & 3 & 1 & 1 & 6 & 6 \\ - & - & - & - & - & - \end{smallmatrix}$, c. $\begin{smallmatrix} 3 & 3 & 1 & 1 & 6 & 6 \\ - & - & - & - & - & - \end{smallmatrix}$; teeth broken or lost; no diastema. Described by Turner in *Challenger Report*, 1887.

Tuesday Bay, Desolation Island, Straits of Magellan.

Donor—Dr R. O. Cunningham.

(3) ARCTOCEPHALUS PUSILLUS. (ARC. PU.)

(Fur Seal of Cape of Good Hope and of Crozet Islands.)

Phoca pusilla, Schreber, *Die Säugethiere*, iii., 1778.*Arctocephalus schisthyperoes*, Turner, *Journ. Anat. and Phys.*, iii., 1868.*Arctocephalus delalandii*, Gray, *Brit. Museum Cat.*, 1866.

Facial part of skull short, forehead flattened; hard palate moderately concave, scooped behind; zygomatic breadth exceeds that of cranium; mandible with faint angle and vertically flattened subcondyloid process. In 1868 I described the adult skull No. 1, and, from the cleft state of the hinder border of the palate, named it *A. schisthyperoes*. It is probably the adult female *A. pusillus*.

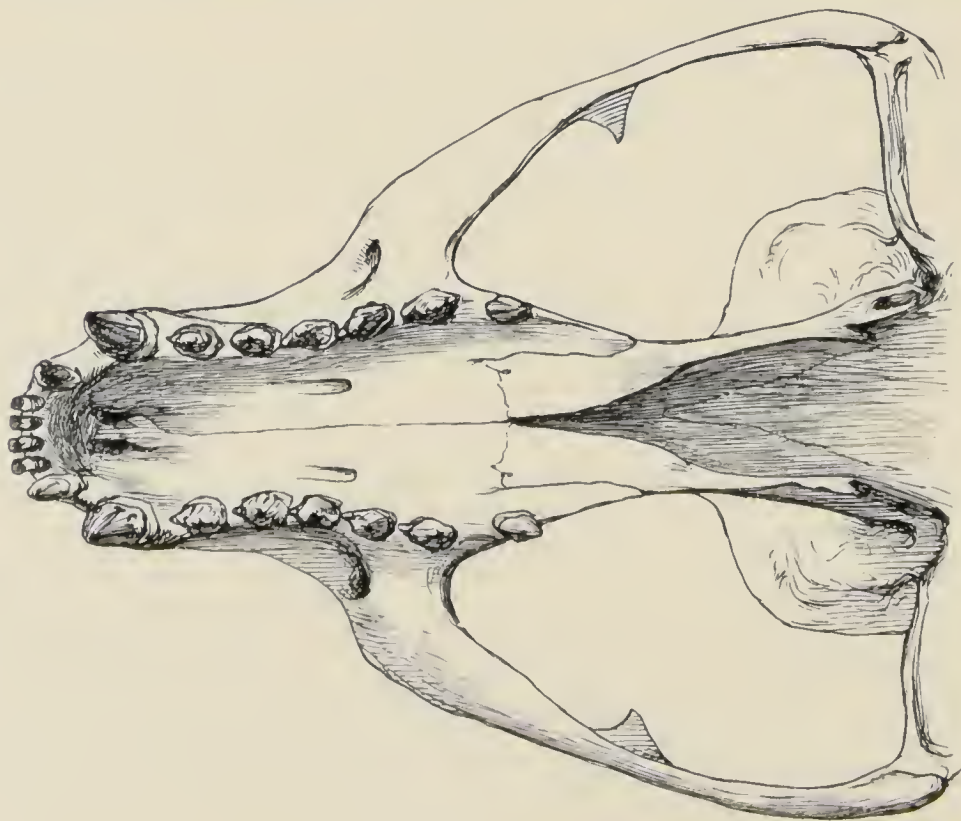
1. **Skull**, adult, probably female; length $8\frac{1}{2}$ inches, over vertex $11\frac{1}{4}$ inches; zygomatic breadth 5 inches; cranial breadth $3\frac{3}{4}$ inches. Hard palate, surface moderately concave, palate bones separated by a wide cleft. Length of maxillary palate $2\frac{7}{8}$ inches.

Mandible length 6 inches. Dentition: in. $\frac{3}{2}$ $\frac{3}{2}$, c. $\frac{1}{1}$ $\frac{1}{1}$.

p.c. $\frac{6}{5}$ $\frac{6}{5}$. Large cusp with small supplementary, no diastema. Described by Turner, in *Journ. Anat. and Phys.*, vol. iii., 1868, as *A. schisthyperoes*. Palatal aspect figured below.

Cape of Good Hope.

Turner Collection.



2. **Stomach** of a Seal, dried, probably from *A. pusillus*. It contains a number of smooth pebbles, flattened at the sides, from the size of a coffee bean to a diameter of $1\frac{1}{2}$ inch. It was sent from the Cape of Good Hope and labelled "Seal's Ballast Bag."

Challenger Collection.

(4) ARCTOCEPHALUS GAZELLA. (ARC. GA.)

(Kerguelen Island Fur Seal.)

Otaria (Arctophora) gazella, *Peters, Monatsbericht, preuss. Akad. d. Wiss.*, 1875, 1876.

Sagittal crest absent; tympanic almost flattened; mastoid moderate; upper and lower post-canines with one large cusp and no secondary cusp; 6th post-canine much smaller than the others.

1. **Skeleton**, not adult, vertebral plates and epiphyses not fused. Length of spine along curve 3 feet $7\frac{1}{2}$ inches, of skull $8\frac{1}{4}$ inches; total length of skeleton 4 feet $3\frac{3}{4}$ inches. Vertebral formula $C_7D_{15}L_5S_2Cd_{10}=39$. Ribs, fifteen pairs. Sternum, nine segments. Scapula falcate, diameter between angles $7\frac{1}{4}$ inches, glenoido-vertebral $5\frac{1}{4}$ inches, præspinous about three times larger than postspinous fossa, acromion rudimentary, no coracoid. Humerus 6 inches long, no supracondyloid foramen; radius $5\frac{3}{8}$ inches; ulna $6\frac{1}{4}$ inches, with large olecranon. Manus pentadactylous, digits diminish in length from pollex to minimus. Pelvic bone $5\frac{3}{4}$ inches long; iliac crest directed forwards and outwards; femur $3\frac{3}{8}$ inches; tibia and fibula partially fused at upper end, tibia $6\frac{1}{2}$ inches, fibula $5\frac{3}{4}$ inches. Pes digits almost equal in length; tarsalia, eight bones with an entoscaphoid. Length over vertex 11 inches; zygomatic breadth $4\frac{3}{4}$ inches. Palate slightly concave on surface, $3\frac{1}{2}$ inches long; posterior border concave from mid suture to pterygoid 1 inch. Mandible length $5\frac{1}{4}$ inches. Dentition: p.c. $\frac{6}{5} \frac{6}{5}$, not closely set, small diastema between upper 5 and 6. Peters examined this skull and considered it to be an example of *A. gazella*.

The characters of the skeleton in *A. australis* and *A. gazella* are compared with each other by Turner in *Challenger Report* on Seals. Kerguelen Island, Fuller's Harbour.

Challenger Collection.

2. **Skull** of young animal. Length $6\frac{3}{8}$ inches, over vertex $9\frac{1}{4}$ inches; cranial breadth 4 inches; right zygoma broken. Hard palate, length $2\frac{5}{8}$ inches, faintly concave; posterior border crescentic, $\frac{3}{4}$ inch from hamulars. Mandible length 4 inches, subcondylar process incurved, horizontally flattened; upper post-canines partially erupted; lower milk dentition.

Betsy Cove, Kerguelen.

Challenger Collection.

(5) ARCTOCEPHALUS PHILIPPI. (ARC. PH.)

(Fur Seal of Juan Fernandez.)

Otaria philippii, Peters, *Mon. d. k. preuss. Akad. Wiss. Berlin*, 1866.

Peters has described this seal as a distinct species with the above name. Allen regards it as *A. australis*. Peters figures only five upper post-canines in his specimen. The specimen is too young to furnish distinctive characters. It was from a pup given alive to Sir Wyville Thomson, and caught at Juan Fernandez.

1. **Skull** with mandible. Length of animal 1 foot $7\frac{1}{4}$ inches. Length of skull $4\frac{3}{4}$ inches; zygomatic breadth $2\frac{1}{8}$ inches; cranial breadth $3\frac{1}{8}$ inches. Hard palate with posterior border concave, not reaching hamular pterygoids. Milk dentition: in. $\frac{3}{2}$ $\frac{3}{2}$, c. $\frac{1}{1}$ $\frac{1}{1}$, p.c. $\frac{6}{5}$ $\frac{6}{5}$. Mandible, length 3 inches. See Turner in Report on Seals.

Juan Fernandez.

Challenger Collection.

ARCTOCEPHALUS, sp. uncertain.

1. **Skeleton** and skull of young animal. Imperfect dentition: milk canines in place, post-canines in course of eruption.

Imbedded in guano from Chincha Islands, 1860.

Turner Collection.

Family III. PHOCIDÆ.

(Earless Seals.)

No external ear; no scrotum; no alisphenoid canal; inner wall of orbit complete or almost complete. Hard palate with posterior border either truncated

or scooped, widest part almost in line with last pair of upper post-canines; anterior nares not terminal. Hind limbs directed backwards; pelage hairy, no fur; palms and soles hairy; astragalus with long calcaneal process.

Subfamily I. PHOCINÆ.

Anterior nares oblique, in front of infra-orbital foramen; beak a little prolonged in front of anterior nares; no post-orbital process; inner wall of orbit entire or almost entire; interorbital part of frontal compressed laterally; widest part of hard palate behind molars; zygomatic process of maxilla slightly prolonged below malar; premaxilla articulating with nasal; pterygoids vertical; tympanic bullæ swollen. Mandible with angle and subcondyloid process. Nails strong; toes of hind foot almost equally long. Humerus with supracondyloid foramen. Females smaller than males. Dentition: in. $\frac{3}{2}$ $\frac{3}{2}$, c. $\frac{1}{1}$ $\frac{1}{1}$, p.c. $\frac{5}{5}$ $\frac{5}{5}$ = 34.

I. PHOCA. (Pho.)

Phoca, *Linnaeus*, *Syst. Nat.*

Anterior nares not high; infra-orbital foramen opens into floor of orbit. Tympanic swollen, smooth, with oblique ridge. Dentition: post-canines with more than one cusp, fangs two-rooted, except in first post-canine.

(1) PHOCA VITULINA. (PHO. V.)

(Common Harbour Seal, North Sea and North Atlantic.)

Phoca vitulina, *Linnaeus*, *Syst. Nat.*, 1758.

Callocephalus vitulinus, *F. Cuvier*, *Dict. Sci. Nat.*, xxxix., 1826; *Gray*, *Cat. Osteol. Brit. Museum*, 1847; *Seals*, 1850; *Seals and Whales*, 1874.

Selch, *Scottish local name*.

Colour variable; above, yellowish grey with dark brown or black spots, streaks, or patches; beneath, yellowish white with small dark brown spots. Young, at birth, whitish or yellowish white. Length of male 5 to 6 feet. Vertebral formula

$C_7D_{15}L_5S_4Cd_{10}=41$. Post-canines or molars set obliquely, cuspidate, no diastema. Skull relatively large, nose broad, body short, limbs short. Subcondyloid process of mandible short, inverted, distinct from tubercle at angle. Hard palate scooped at posterior border. Basi-occipital with mesial hole. Interorbital compression well marked.

1. **Specimen, stuffed**, caught in the Firth of Forth, 1886. Colour grey on back and sides, thickly studded with black and dark brown spots; belly greyish yellow with the dark spots much more scattered; bristles whitish; manus, pes, and tail with dark spots diffused. Length to tip of tail 5 feet 2 inches, to tip of pes 5 feet $6\frac{1}{2}$ inches. Length of pectoral limb from axilla to tip $5\frac{7}{8}$ inches, of hind limb 8 inches, of tail $3\frac{1}{2}$ inches. Girth behind pectoral limbs 3 feet 8 inches. Muzzle $4\frac{1}{8}$ inches broad. A few bristles above upper eyelid.
2. **Skeleton**, young, with milk dentition. Length to tip of tail 2 feet 5 inches. Vertebrae forty-one in number. Fifteen pairs of ribs. Sternum with ten segments.
3. **Skeleton**, young, bones of, not articulated; ossification very incomplete. Skull, length 6 inches, over vertex $8\frac{1}{2}$ inches; zygomatic breadth $3\frac{5}{8}$ inches; cranial $3\frac{3}{8}$ inches. Hard palate scooped out, not reaching hamulars, shallow. Tympanic bulla large; post-canines $\frac{5}{5} \frac{5}{5}$, usually three cusps, occasionally four cusps. Mandible $3\frac{3}{4}$ inches long. Turner Collection.
4. **Skeleton**, young, bones of, not articulated; ossification incomplete. Skull, length 6 inches, over vertex $8\frac{3}{8}$ inches; zygomatic breadth $3\frac{1}{2}$ inches, cranial $3\frac{3}{8}$ inches. Length of mandible $3\frac{5}{8}$ inches.
5. **Skull**, aged. Length $8\frac{1}{4}$ inches, over vertex $10\frac{1}{2}$ inches; zygomatic breadth 5 inches, cranial $3\frac{3}{4}$ inches. Hard palate deeply scooped, not reaching hamulars, slightly concave. Tympanic bullae large. Orbital border incomplete. Teeth cuspidate and worn. Mandible $5\frac{1}{2}$ inches; subcondylar process a vertical ridge.
Donor—Dr A. Fleming.
6. **Skeleton**, adult, not articulated. Skull, length $7\frac{3}{4}$ inches, over vertex $10\frac{1}{4}$ inches; zygomatic breadth $4\frac{7}{8}$ inches;

cranial $3\frac{1}{2}$ inches. Hard palate deeply scooped, not reaching hamulars, slightly concave; post-canines with sometimes four cusps. Mandible 5 inches; subcondylar process as in No. 5.

7. **Skull** of adult, wanting right malar. Teeth worn. Skull, length 8 inches, over vertex, $9\frac{3}{4}$ inches; breadth, zygomatic, $4\frac{7}{8}$ inches, cranial $3\frac{3}{8}$ inches. Mandible, length $5\frac{1}{4}$ inches.
8. **Ligamentum** Conjugale Costarum exposed on the back of the intervertebral disc of *Phoca vitulina* and extending transversely between the heads of opposite ribs. The ligament was invested by a synovial membrane continuous with that of the costo-vertebral joints. Described by Dr John Cleland in *Edinburgh New Philosophical Journal*, ix., 1859.
9. **Forearm** and Manus, *Phoca vitulina*. Carpus consists of radiale, intermedium, ulnare, pisiform; four distal carpalia.
10. **Manus** of *Phoca vitulina*, 1st and 2nd digits of, to show the epiphyses of the metacarpals and phalanges. The 1st metacarpal and all the phalanges have only proximal epiphyses; the four other metacarpals have only distal epiphyses. Prepared by Mr A. B. Stirling, 1869.
11. **Hip Joint** of *Phoca vitulina*. The capsule has been opened and the head of the femur exposed to show the absence of the ligamentum teres.
12. **Pes** of *Phoca vitulina*, 1st and 2nd digits of, to show the epiphyses of the metatarsals and phalanges. The 1st metatarsal has both a proximal and a distal epiphysis, as also the phalanges, except the terminal phalanx, which has only a proximal epiphysis. In the four other metatarsals only a distal epiphysis is present. Prepared by Mr A. B. Stirling, 1869.
13. **Placenta**, portion of the detached, of *Phoca vitulina*. The lobules have been partially separated from each other.
14. **Brain** of *Phoca vitulina*. Membranes removed; convolutions displayed. Described by Turner in *Journ. Anat. and Phys.*, vol. xxii., 1888, and *Challenger Report*, part lxviii., 1887.
15. **Brain** of *Phoca vitulina* cut into sections.

(2) PHOCA GRÆNLANDICA. (PHO. GR.)

(Harp Seal, Saddleback, North Atlantic and Arctic Oceans.)

Phoca grænlandica, *Fabricius in Müller's Zool. Dan. Prod.*, 1776, and in *Fauna Grænland.*, 1780.

Colour tawny grey, nose and front of head black, saddle-shaped black mark on sides extending from shoulders to tail. In the young animal the mark has not formed, but the grey colour is interspersed with large dark spots. Length from 5 to 6 feet. Vertebral formula $C_7D_{15}L_5S_3Cd_{13}=43$. Post-canines $\begin{smallmatrix} 5 & 5 \\ \bar{5} & \bar{5} \end{smallmatrix}$, not closely set, not oblique; large cusp with one or two supplementary cusps in upper and three supplementary cusps in the lower. Tympanic bulla prolonged into wall of external meatus, the aperture of which looks forwards. Large triangular area on top of cranium, bounded on each side by a marked ridge. Hard palate truncated, shallow, reaching hamulars. Mandible with triangular, inverted, subcondylar process distinct from tubercle at angle; coronoid long, pointed, the two halves parallel and close together for almost their anterior half, and then diverging. Interorbital compression not so marked as in *vitulina*.

1. **Skull**, adult. Length $8\frac{1}{2}$ inches, over vertex $10\frac{1}{2}$ inches; breadth, zygomatic $4\frac{7}{8}$ inches, cranial 4 inches. Mandible, length $5\frac{3}{8}$ inches.

North Atlantic.

Donor—Dr A. Fleming.

2. **Skull**, adult. Length 8 inches, over vertex $10\frac{1}{4}$ inches; breadth, zygomatic 4^1 inches, cranial $3\frac{7}{8}$ inches. Mandible $5\frac{1}{8}$ inches.

Donor—Dr James Foulis, Lamont Expedition.

3. **Skull**, adult. Length $8\frac{1}{4}$ inches, over vertex 10 inches; breadth, zygomatic $4\frac{1}{2}$ inches, cranial $3\frac{3}{4}$ inches. Mandible 5 inches.

North Atlantic.

Donor—Dr A. J. M. Bentley, Lamont Expedition.

4. **Skull**, adult. Length $8\frac{3}{8}$ inches, over vertex $10\frac{3}{8}$ inches; breadth, zygomatic 5 inches, cranial 4 inches. No mandible.

North Atlantic.

5. **Skull**, damaged. Length $8\frac{1}{4}$ inches, over vertex 10 inches. Breadth, zygomatic $4\frac{1}{2}$ inches; cranial $3\frac{7}{8}$ inches. Mandible, length $5\frac{1}{8}$ inches.

Collected by Dr Robert Brown, 1861.

Purchased from Dr M'Bain's Collection.

6. **Skull**, occipito-sphenoid joint not ankylosed. Length $8\frac{3}{8}$ inches, over vertex $10\frac{1}{4}$ inches; breadth, zygomatic $5\frac{1}{4}$ inches; cranial 4 inches. Mandible, length $5\frac{1}{2}$ inches.

North Atlantic.

Donor—Mr Chas. Edward Smith, s. "Diana" of Hull, 1869.

7. **Skull**, occipito-sphenoid joint not ossified. Length $8\frac{1}{8}$ inches, over vertex 10 inches; breadth, zygomatic $4\frac{3}{4}$ inches; cranial $3\frac{3}{4}$ inches. Mandible $5\frac{1}{8}$ inches.

Donor—Dr James Foulis, Lamont Expedition.

8. **Skull**, much broken. Breadth, zygomatic $4\frac{7}{8}$ inches, cranial 4 inches. Mandible $5\frac{1}{8}$ inches.

Donor—Dr James Foulis.

9. **Skull**, young, no mandible. Length $7\frac{1}{8}$ inches, over vertex 9 inches; breadth, zygomatic 4 inches, cranial $3\frac{7}{8}$ inches.

North Atlantic.

10. **Skull**, young. Length 7 inches, over vertex 9 inches; breadth, zygomatic $3\frac{3}{4}$ inches, cranial $3\frac{5}{8}$ inches. Mandible, length $4\frac{1}{4}$ inches.

North Atlantic.

11. **Skull**, young. Length $6\frac{1}{2}$ inches, over vertex $8\frac{1}{2}$ inches; breadth, zygomatic $3\frac{5}{8}$ inches, cranial $3\frac{5}{8}$ inches. Mandible, length 4 inches.

North Atlantic.

12. **Skull**, young. Length $6\frac{1}{8}$ inches, over vertex $8\frac{1}{2}$ inches; breadth, zygomatic $3\frac{1}{2}$ inches, cranial $3\frac{1}{2}$ inches.

North Atlantic.

13. **Skull**, young. Length 6 inches, over vertex $8\frac{1}{8}$ inches; breadth, zygomatic $3\frac{1}{4}$ inches, cranial $3\frac{5}{16}$ inches. Mandible $3\frac{1}{2}$ inches.

North Atlantic.

14. **Skull**, young, probably *Phoca granlandica*. Length $5\frac{1}{2}$ inches, over vertex $7\frac{1}{2}$ inches; breadth, zygomatic $3\frac{1}{4}$ inches, cranial $3\frac{1}{8}$ inches. Mandible $3\frac{3}{8}$ inches. Independent ossification in bregma.

15. **Skull**, young, *Phoca grænlandica*. Zygomatic arches broken. Length $6\frac{1}{8}$ inches, over vertex $8\frac{1}{4}$ inches. Breadth $3\frac{3}{8}$ inches. Mandible, length $3\frac{5}{8}$ inches.
16. **Scapula** and Humerus, right, articulated. Post-sphenoid fossa slightly larger than pre-spinous; coracoid stunted, no acromion. Humerus, length $4\frac{1}{2}$ inches, with supracondyloid foramen.
17. **Whiskers**, three large bristles of the Harp Seal, nearly 6 inches long.
18. **Fœtus** of *Phoca grænlandica*, $7\frac{1}{4}$ inches long; the brain is figured in *Challenger Report* on Seals, pl. viii. fig. 4.

(3) PHOCA HISPIDA. (PHO. H.)

(Ringed Seal or Floe Rat, North Atlantic and Arctic Oceans.)

Phoca hispida, Schreber, *Die Säugethiere*, 1778.

Phoca fœtida, Fabricius, *Fauna grænlandica*, 1780.

Phoca annellata, Nilsson, *Skand. Fauna*, 1820.

Blackish on back, sides lighter with white spots, belly yellowish white. Length 4 to 5 feet; the smallest species of *Phoca*. Vertebral formula $C_7D_{15}L_5S_4Cd_{14} = 45$. Interorbital part of cranium greatly attenuated: inner wall of orbit complete. Post-canines neither crowded nor oblique, bi- or tricuspidate in upper jaw, frequently quadricuspidate in lower jaw, the second cusp being the largest. Hard palate concave at posterior border. Mandible with subcondylar process forming a vertical ridge, inverted, distinct from tubercle at angle; coronoid pointed. Basis-occipital defective laterally and mesially. Tympanic smooth, with strong ridge anteriorly.

1. **Skull**, male, nearly adult. Length $5\frac{7}{8}$ inches, over vertex 8 inches. Breadth, zygomatic $3\frac{5}{8}$ inches, cranial $3\frac{3}{8}$ inches. Mandible, length $3\frac{5}{8}$ inches.
Lat. $73^\circ 22'$ N., long. $13^\circ 28'$ W.
Donor—Dr Robert Gray, Peterhead.
2. **Skull**. Length $5\frac{7}{8}$ inches, over vertex $7\frac{1}{2}$ inches; breadth, zygomatic $3\frac{5}{8}$ inches, cranial $3\frac{1}{4}$ inches. Mandible, length $3\frac{5}{8}$ inches.
Lat. $74^\circ 43'$ N., long. $11^\circ 30'$ W.
Donor—Dr Robert Gray, Peterhead.
3. **Skull**, adult. Length $6\frac{5}{8}$ inches, over vertex $8\frac{1}{2}$ inches;

breadth, zygomatic $4\frac{1}{8}$ inches, cranial $3\frac{1}{4}$ inches. Mandible, length $4\frac{1}{2}$ inches. Collected by Dr Robert Brown, Lamont Expedition, 1869.

North Atlantic.

McBain Collection.

4. **Skeleton**, disarticulated, of young *Phoca hispida*. Skull, length $5\frac{1}{2}$ inches, over vertex $7\frac{1}{2}$ inches; breadth, zygomatic $3\frac{1}{4}$ inches, cranial $3\frac{1}{4}$ inches. Mandible $3\frac{3}{8}$ inches. Humerus with supracondyloid foramen. Scapula, post-spinous larger than pre-spinous fossa; coracoid and acromion rudimentary. Ilium with an everted crest. 1882.
5. **Skull**, not adult, of *Phoca hispida*, broken. Length $6\frac{5}{8}$ inches, over vertex $8\frac{1}{4}$ inches; breadth, zygomatic $3\frac{7}{8}$ inches. Mandible $4\frac{1}{8}$ inches.
Donor—Mr W. Stewart Campbell, Dundee, October 1881.
6. **Skull** of young *Phoca hispida*, very imperfect. Cranial breadth 3 inches. From Spitzbergen, 1869.
7. **Skull**, much broken, probably *Phoca hispida*. Length of mandible $3\frac{7}{8}$ inches. Donor—Dr James Foulis.
8. **Skeleton**, adult, imperfect, disarticulated, regarded as *Phoca hispida*, found in brick-clay at Puggiston, Montrose. Humerus, length 3.5 inches, with supracondyloid foramen. Radius, length 3.95 inches: ulna, length 5 inches. Described by Turner in *Journ. Anat. and Phys.*, vol. iv, 1870. The cuspidation of



the post-canine teeth and their mode of implantation in the jaws, together with the form of the mandible, gave characters which showed that the fossil closely resembled *Phoca hispida* and distinguished it from both *vitulina* and *grænlandica*. In the figure on p. 185 the bone with broken coronoid is the fossil, and the jaw below it is *Phoca hispida*,

Montrose.

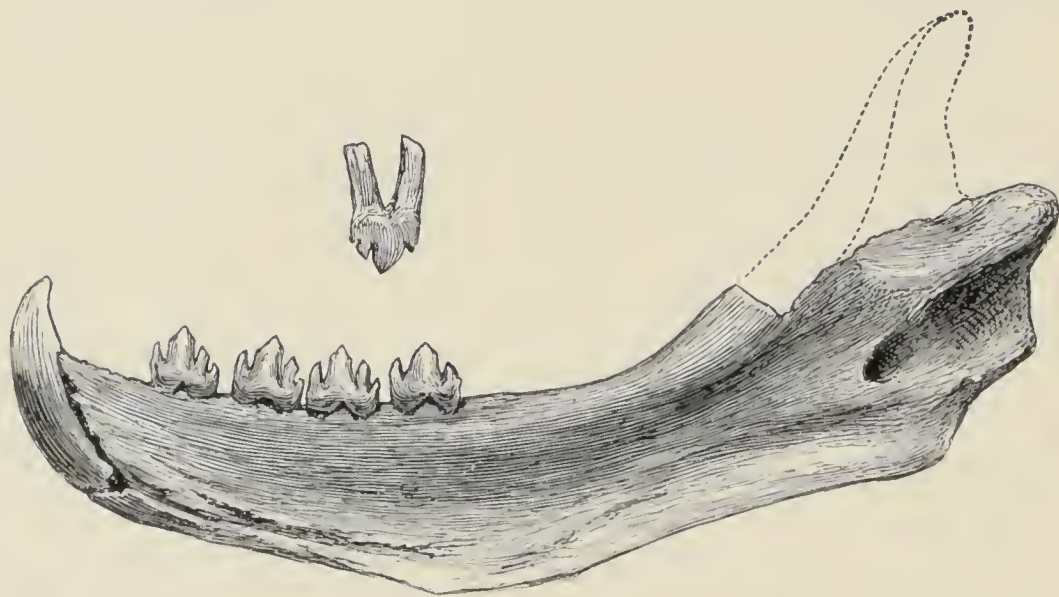
Donor—Dr Jas. C. Howden.

9. **Vertebræ**, and portions of Ribs, of a Seal regarded as *Phoca hispida* Found in brick-clay near Errol. See memoir by the Rev. Thos. Brown in *Trans. Roy. Soc. Edin.*, vol. xxiv.

Donor—Rev. Thos. Brown.

10. **Skeleton**, portions of, from a young Seal regarded as *Phoca hispida*, found in 1869 near Grangemouth, in a stratum of clay, whilst sinking the shaft of a coal pit. Described by Turner in *Journ. Anat. and Phys.*, vol. iv., 1870. The figure below shows the inner surface of the jaw; the most anterior post-canine is lost, and the separate tooth is from the upper jaw.

Donor—Dr Wm. Stirling.



11. **Humerus**, Radius, Ulna, adult, found in brick-clay, Dunbar, in 1878. The humerus, 4.1 inches long, does not have a supracondyloid foramen. Radius 4.15 inches, ulna 5.2 inches. Described by D'Arcy W. Thompson in *Journ. Anat. and Phys.*, vol. xiii, 1879. These bones are not from *Phoca hispida*, nor indeed from any species of the Phocinae. The supracondyloid foramen is absent, although present in both *Phoca* and *Halichærus*, but not in the Eared Seals. Figure on page 187.

Donor—Dr D'Arcy Thompson.

(4) PHOCA BARBATA. (PHO. B.)

(Bearded Seal, North Atlantic and Arctic Oceans.)

Phoca barbata, *Fabricius, Fauna græland.*, 1780.*Erignathus barbatus*, *Gill, Proc. Essex Inst.*, v., 1866; *Allen, N. Amer. Pinn.*, 1880.

Back grey or brown, darker on the middle, sides greyish white, belly white. Length 7 to 8 feet. Vertebral formula $C_7D_{15}L_5S_4Cd_{13}=44$. Post-canines with distinct intervals, not strongly implanted. Teeth feeble. Tympanic bulla swollen, rougher than in other species of *Phoca*. Hard palate truncated behind, almost reaching hamulars. Skull broad, orbits small, interorbital region only slightly compressed; nasal passages large; mandible weak, its subcondylar process large, inverted, triangular, continued by a ridge into angle; basi-occipital not perforated. The characters of the cranium, especially those of the lower jaw, the flattening of the zygomatica, so that the cranial breadth is almost the same as the zygomatic, the ridge along the sagittal suture, the broad muzzle, the long narrow scapula, without an acromion, the middle digit in the manus being the longest, the absence of an abrupt eversion of the iliac crests, and the presence of four mammae instead of two, have led Messrs Gill and Allen to separate *barbata*



from the other species of *Phoca*, and to regard it as a distinct genus, *ERIGNATHUS*.

1. **Skull**, aged. Length $9\frac{1}{4}$ inches, over vertex $12\frac{1}{2}$ inches; breadth, zygomatic $5\frac{1}{4}$ inches, cranial $4\frac{1}{4}$ inches. Mandible 6 inches. Crowns of teeth worn away.

Donor—Mr Jas. Simpson.

2. **Skull**, adult. Length $8\frac{3}{4}$ inches, over vertex $11\frac{3}{4}$ inches; breadth, zygomatic 5 inches, cranial $4\frac{3}{8}$ inches. Mandible $5\frac{1}{2}$ inches. Teeth much worn; occipital and squamous ridges.

North Atlantic.

Donor—Dr James Foulis.

3. **Skull**, aged. Length $9\frac{1}{4}$ inches, over vertex $12\frac{1}{2}$ inches; breadth, zygomatic 5 inches, cranial $4\frac{3}{8}$ inches. Occipital and squamous ridges. No mandible. Teeth feeble, many sockets absorbed.

North Atlantic.

Purchased from Dr M'Bain's Collection.

[Nos. 4 to 8 are from the Turner Collection.]

4. **Skull**, aged. Length 9 inches, over vertex $12\frac{1}{4}$ inches; breadth, zygomatic 5 inches; cranial $4\frac{5}{8}$ inches. Mandible 6 inches. Teeth worn, marked interval between 4th and 5th upper post-canines. Cranium with occipital and squamous ridges.

North Atlantic.

5. **Skull**, aged. Length $8\frac{1}{2}$ inches, over vertex 12 inches. breadth, zygomatic 5 inches, cranial $4\frac{3}{8}$ inches. Mandible $5\frac{3}{4}$ inches. Occipital and squamous ridges. Alveoli absorbed.

North Atlantic.

6. **Skull**, aged, premaxillæ lost. Breadth, zygomatic 5 inches, cranial $4\frac{1}{4}$ inches. Occipital and squamous ridges. Teeth lost. No mandible.

North Atlantic.

7. **Skull**, basi-cranial joint not closed. Length $7\frac{7}{8}$ inches, over vertex $11\frac{1}{2}$ inches; breadth, zygomatic $4\frac{5}{8}$ inches, cranial $4\frac{1}{4}$ inches. Tympanic bulla smooth in inner half, rough in outer. Mandible $5\frac{1}{4}$ inches long.

North Atlantic.

Donor—Mr C. E. Smith, 1869.

8. **Skull**, young, imperfect. Length $5\frac{3}{8}$ inches, over vertex

7½ inches; breadth, cranial 3 inches. No mandible. Teeth, post-canines with secondary cusps. Tympanic bulla smooth.

North Atlantic.

9. **Skull**, adult, much broken. Length 9¼ inches, over vertex 12½ inches; breadth, zygomatic 5 inches, cranial 4⅔ inches. Mandible, length 6 inches. Teeth worn.
Donor—Mr Jas. Simpson.
10. **Skull**, disarticulated, of young Bearded Seal.
11. **Os penis**, 6½ inches long; girth at base 3½ inches; probably from *Phoca barbata*.

II. HALICHÆRUS. (Hal.)

Halichærus, Nilsson, *Fauna Skand.*, i., 1820.

Cranium only about one-third the length of the skull; facial part proportionally large and broad, orbits large, interorbital region thick; molars conical, length and breadth about equal, mostly single-rooted. Pre-maxillæ articulate with nasal.

(1) HALICHÆRUS GRYPUS. (HAL. GR.)

(Grey Seal, North Sea, North Atlantic.)

Phoca grypus, Fabricius, *Skr. Nat. Selsk.*, i., 1790.

Halichærus grypus, Nilsson, *Kongl. Vet. Akad. Handl. Stockholm*, 1837.

Phoca gryphus, Fischer, *Syn. Mamm.*, 1829.

Colour, silvery grey to yellowish white, with dusky or blackish spots; in the very young, yellowish white with grey stripes; when some months old the tint is slate-grey with black spots. Length about 8 feet in male, from 6 to 7 feet in female. Manus with first and second toes longest; pes, outer toes with long lappets, nails well developed. Interorbital constriction swollen about the middle; occipital and sagittal crests distinct; tympanic bullæ swollen, generally smooth but with an external ridge prolonged into wall of meatus: basi-occipital usually not perforated mesially. Anterior nares high, capacious. Hard palate crescentic at posterior border in front of hamular pterygoids. Mandible with small vertical

subcondylar process distinct from angle, coronoid broadly triangular. Teeth with large, conical cusp, without supplementary cusps, except in young skulls.

1. **Skeleton**, male, not fully adult, articulated, with hyoid apparatus. Length 6 feet 4 inches. Vertebral formula $C_7D_{15}L_5S_2Cd_{14}=43$. Sternum, including terminal cartilages, 23 inches long, nine bony segments. Skull, length in straight line $10\frac{1}{2}$ inches; breadth, zygomatic $6\frac{1}{2}$ inches, cranial 4 inches. Humerus 7 inches, supracondyloid foramen; radius $5\frac{5}{8}$ inches, ulna $7\frac{5}{8}$ inches, olecranon broad, long. Carpus radiale-intermedium, ulnare, pisiform, four distal carpalia. Pelvic bone, length $10\frac{1}{2}$ inches, iliac crest much everted. Femur, length $4\frac{7}{8}$ inches; tibia $10\frac{1}{2}$ inches; fibula 10 inches, fused at upper end. Hallux and 5th toe the longest, seven tarsalia.

Golspie, Sutherland.

Donor—Rev. Dr Joass.

2. **Skeleton**, female, disarticulated, imperfect, face much injured. Skull, length 10 inches; breadth, zygomatic 6 inches, cranial $4\frac{1}{8}$ inches. Mandible $6\frac{5}{8}$ inches; subcondyloid process not inverted nor continuous with angle. Caught at Tents Muir, St Andrews Bay, 1870.

Turner Collection.

3. **Skull**, adult. Length $11\frac{1}{2}$ inches, over vertex $14\frac{1}{2}$ inches; breadth, zygomatic $7\frac{5}{8}$ inches, cranial $4\frac{3}{8}$ inches. Mandible, length 8 inches; sagittal, occipital, and squamous ridges. Anterior nares, greatest width $2\frac{5}{8}$ inches, sagittal diameter $4\frac{1}{2}$ inches.

Shetland.

Donor—Dr Chas. Anderson.

4. **Skull**, adult. Length 10 inches, over vertex $13\frac{1}{4}$ inches; breadth, zygomatic $6\frac{1}{2}$ inches, cranial $4\frac{1}{4}$ inches. Mandible $6\frac{7}{8}$ inches; cranial ridges present. Teeth large and much worn. Anterior nares, width 2 inches, sagittal diameter 3 inches.

Golspie.

Donor—Rev. Dr Joass

5. **Skull**, adult. Length 11 inches, over vertex $14\frac{1}{2}$ inches; breadth, zygomatic $7\frac{1}{8}$ inches, cranial $4\frac{1}{4}$ inches. Mandible $7\frac{3}{4}$ inches; sagittal and occipital ridges, squamous not marked. Teeth loose, fangs bulbous; crowns of canines pointed, post-canines minutely cuspidated, laterally compressed. Anterior nares, greatest width $2\frac{1}{2}$ inches, sagittal diameter $4\frac{1}{8}$ inches.

From Harris, 1862.

Donor—Mr Sharban.

6. **Skull**, young. Length $10\frac{1}{2}$ inches, over vertex 13 inches. Breadth, zygomatic $6\frac{1}{8}$ inches, cranial 4 inches. Mandible $6\frac{3}{4}$ inches. Teeth little worn, the hindmost showing two supplementary cusps, crowns faintly striated vertically. Occipital ridges strong. Mesial foramen in basi-occipital
West Coast of Scotland.
Donor—Capt. Macdonald, F.C. "Vigilant," 1872.
7. **Skull**, imperfect, edentulous except the pair of upper canines. Length 8 inches; breadth, cranial 4 inches. Right mandible $4\frac{3}{4}$ inches. Basi-cranial joint not closed. See Turner in *Journ. Anat. and Phys.*, vol. vii., 1883.
Montrose.
8. **Skull**, young, basi-cranial not closed, with atlas vertebra. Crowns of teeth marked with delicate vertical striæ. Length 8 inches, over vertex 10 inches. Breadth, zygomatic $4\frac{1}{2}$ inches, cranial $3\frac{3}{4}$ inches. Mandible, length 5 inches. Atlas, transverse diameter 3 inches.
9. **Maxillæ**, mandible, and loose teeth of a young Grey Seal, caught at Montrose, 1869. Turner Collection.
10. **Mandible**, adult, and left half of a smaller mandible, from Burrian, N. Ronaldshay. Donor—Dr Wm. Trail.
11. **Mandible**, right half of, found in a kitchen midden, Inchkeith, 1881. Turner Collection.
12. **Skeleton**, imperfect. Scapula with bones of shaft of fore limb, humerus with supracondyloid foramen. Pelvis with bones of shaft of hind limb. From specimen shot on the West Coast of Scotland.
Donor—Capt. Macdonald, F.C. "Vigilant."
13. **Lymphatic** glands, group of, from the root of the mesentery of the Grey Seal. Prepared in 1870.
Turner Collection.
14. **Placenta**, zonary, a large portion of, along with the wall of the uterus, from the Grey Seal, showing the convoluted surface, covered by the allantois and with branches of the umbilical vessels entering its substance. These vessels have been injected. At its margin the placenta has been dishevelled and the injected villi of the chorion exposed. The mother was shot at Sule Skerry, Cape Wrath, in 1872, by Capt. Macdonald. For Placentation of the Grey Seal, see Turner's memoir in *Trans. Roy. Soc. Edin.*, xxvii., 1875.

15. **Placenta** of the same Seal partially separated from the wall of the uterus, the mucous lining of which has been exposed.
16. **Placenta** of the same Seal, chorion and adjacent wall of uterus. The placental margin has the mucous coat of the uterus reflected for a short distance on to its surface.
17. **Placenta** of the same Seal, portion of the chorion beyond the margin of the placenta. The blood-vessels, injected blue, are sparingly distributed.
18. **Generative organs** of a non-gravid female Grey Seal, with the vessels injected. The left ovary contains a corpus luteum. The animal was captured at the mouth of the Tay in 1870.
19. **Ovary** of the Grey Seal, with the pavilion-like arrangement of the Fallopian tube. The ovary has been bisected to show the corpus luteum.

Subfamily II. CYSTOPHORINÆ.

Anterior nares, upper part in vertical or almost vertical plane, beak much prolonged in front of opening, premaxilla not articulating with nasal; greatest width of palate immediately behind last molar; zygomata very bulging, width much more than cranial breadth; inner wall of orbit somewhat defective; pterygoids almost vertical. Basi-occipital usually not perforated mesially.

I. CYSTOPHORA. (Cy.)

Cystophora, Nilsson, *Skand. Fauna*, i., 1820.

Anterior nares in upper third or half bounded by superior maxilla; tympanic bulla very swollen, outer third rough and continuous with short external meatus, which opens outwards; infra-orbital foramen opens on lower part of slope of anterior floor of orbit; mastoid temporal prominent; posterior edge of vomer articulating with palate in plane of posterior nares. Dentition: in. $\frac{2}{1} \frac{2}{1}$, c. $\frac{1}{1} \frac{1}{1}$, p.c. $\frac{5}{5} \frac{5}{5}$ = 30. Crowns of post-canines small, laterally compressed, faintly cuspidated.

(1) CYSTOPHORA CRISTATA. (CY. CR.)

(Crested, Hooded, or Bladder-nosed Seal, North Atlantic, Arctic Ocean.)

Phoca cristata, *Erxleben, Syst. Reg. Anim.*, 1777.*Cystophora cristata*, *Gray, Zool. Voy. Erebus and Terror*, 1844.

Colour bluish black above, lighter on sides and belly with irregular spots, head and limbs black. Adult males with inflated narial sac. First and fifth toes of pes longer than intermediate toes, nails rudimentary or absent. Anterior nares capacious, widest in upper third. Hard palate truncated at posterior border, reaching close to hamulars. Mandible with longitudinal incurved subcondyloid ridge not reaching angle; coronoid elongated. Length of male 7 to 8 feet, of female about 7 feet. Vertebral formula $C_7D_{15}L_5S_4Cd_{10}=41$.

1. **Skull**, adult. Length 11 inches, over vertex $15\frac{1}{4}$ inches; breadth, zygomatic $8\frac{1}{4}$ inches, cranial $5\frac{1}{4}$ inches. Mandible $7\frac{1}{2}$ inches; pair of sagittal ridges separated by triangular interspace. Teeth a little worn. Anterior nares, sagittal diameter $3\frac{3}{4}$ inches, transverse $2\frac{3}{8}$ inches.

North Atlantic.

Donor—Dr James Foulis.

2. **Skull**, adult. Length $10\frac{3}{4}$ inches, over vertex $14\frac{3}{4}$ inches; breadth, zygomatic $8\frac{3}{4}$ inches, cranial $5\frac{1}{4}$ inches. No mandible. Anterior nares, sagittal $3\frac{3}{4}$ inches, transverse diameter $2\frac{1}{2}$ inches. Teeth absent; pair of sagittal ridges.

North Atlantic.

Turner Collection.

3. **Skull**, adult. Length 10 inches, over vertex $14\frac{1}{4}$ inches; breadth, zygomatic $8\frac{1}{8}$ inches, cranial $5\frac{1}{4}$ inches. Mandible $7\frac{1}{4}$ inches. Teeth only a little worn; pair of sagittal ridges

Turner Collection.

4. **Skull**, adult. Right tympanic wanting. Length $10\frac{3}{4}$ inches, over vertex $14\frac{3}{8}$ inches. Breadth, zygomatic $7\frac{3}{4}$ inches, cranial 5 inches. Mandible $7\frac{1}{4}$ inches. Teeth worn; pair of sagittal ridges.

North Atlantic.

Turner Collection.

5. **Skull**, young adult, male. Length $9\frac{1}{4}$ inches, over vertex $11\frac{3}{4}$ inches. Breadth, zygomatic $6\frac{1}{4}$ inches, cranial $4\frac{5}{8}$ inches. Mandible 6 inches. Teeth a little worn.

Greenland Sea, north of Jan Mayen Island.

Donor—Dr Rt. Brown, 1861.

6. **Skull**, with atlas and axis, young. Length 8 inches, over vertex $10\frac{1}{2}$ inches. Breadth, zygomatic $5\frac{1}{2}$ inches, cranial $4\frac{3}{8}$ inches. Mandible 5 inches. Teeth not worn: no sagittal ridges. Hole in basi-occipital.
North Atlantic. Donor—Dr James Foulis.
7. **Skull**, not adult. Length $9\frac{1}{2}$ inches, over vertex 13 inches. Breadth, zygomatic $6\frac{5}{8}$ inches, cranial $4\frac{1}{2}$ inches. Mandible $6\frac{1}{2}$ inches. Teeth not worn; sagittal ridges feeble. Hole in basi-occipital.
North Atlantic. Donor—Dr James Foulis.
8. **Skull**, young. Length $7\frac{3}{4}$ inches, over vertex $10\frac{1}{2}$ inches: breadth, zygomatic $5\frac{5}{8}$ inches, cranial $4\frac{1}{2}$ inches. Mandible $4\frac{3}{4}$ inches. Teeth not worn. Hole in basi-cranial. No sagittal ridges.
North Atlantic. Donor—Dr James Foulis.
9. **Mandible**, right half of. Length 6 inches. Teeth absent.
Donor—Dr Rt. Brown.
10. **Skull**, disarticulated, of a young Crested Seal.
11. **Generative Organs** of a female Crested Seal which died in the Zoological Gardens, London, about three months after parturition. The left uterine cornu has been opened to show the folds of mucous membrane; the vessels were injected by Mr A. B. Stirling. Turner Collection.
12. **Vagina** of the same Crested Seal, the anterior wall of which has been divided to show the folds of the mucous membrane. A bristle has been inserted into a duct which traverses the vaginal wall in an upward direction. The rectum has been opened to show the vascularity of the mucous membrane.
Turner Collection.

II. MACRORHINUS. (Mac.)

Macrorhine, *F. Cuvier, Mém. Hist. Nat.*, xi., 1824.

Premaxillæ with horizontal part only present, sides of anterior nares formed only of superior maxillæ; tympanic bulla not much swollen, relatively flattened, outer part prolonged into an expanded tympanic plate, which becomes an elongated external meatus: infra-orbital foramen opens below the slope of anterior floor of orbit; mastoid process scarcely distinguishable; posterior edge of vomer articulating in front of truncated border of hard palate; inter-

orbital region much swollen. Dentition: in. $\frac{2}{1} \frac{2}{1}$,
 c. $\frac{1}{1} \frac{1}{1}$, p.c. either $\frac{5}{5} \frac{5}{5}$ or $\frac{4}{4} \frac{4}{4}$; canines large, with
 conical fluted crowns, fangs simple. Vertebral
 formula $C_7D_{15}L_5S_3Cd_{10}=40$. Body bulky; males 15
 to 20 feet long, much larger than females; males
 with a tubular proboscis.

(1) MACRORHINUS LEONINUS. (MAC. L.)

(Elephant Seal, Southern and Antarctic Oceans.)

(The only species.)

Phoca leonina, *Linnaeus*, *Syst. Nat.*, 1758.

Phoca elephantina, *Molina*, *Saggio sul. Stor. Nat. del Chili*,
 1782.

External Characters, Skeletons, and Skulls of the
 Elephant Seal were described and figured by Turner
 in his *Challenger Report, Zoology*, part lxviii., 1887.

1. **Skull**, male (*h*). Length from end of premaxilla to occipital condyl $19\frac{1}{8}$ inches, over vertex $25\frac{1}{2}$ inches; breadth, zygomatic $13\frac{5}{8}$ inches, of cranium at squamous sutures $8\frac{1}{4}$ inches; length of hard palate $9\frac{3}{4}$ inches; greatest width of anterior nares $3\frac{8}{10}$ inches, lateral boundaries steep and almost in the plane of the front of the zygomatic arch. Mandible, length $13\frac{5}{8}$ inches; subcondyloid process not inverted and not continuous with the angle. Basi-occipito-sphenoid joint not ossified, no foramen in basi-occipital; large occipital crest, sagittal crest feeble and bifurcated. Dentition: p.c. $\frac{5}{5} \frac{5}{5}$.

Heard Island.

Challenger Collection.

2. **Skeleton**, well-grown male (*e*), from Betsy Cove, Kerguelen. Basi-cranial joint open, plates not fused with vertebral bodies, nor epiphyses with long bones. Spine 8 feet 5 inches long, skull 15 inches, skeleton 10 feet long, greatest width of atlas $7\frac{3}{4}$ inches. Vertebral formula $C_7D_{15}L_5S_3Cd_{10}=40$. Ribs, fifteen pairs, of which nine articulated with sternum, which consisted of nine segments. Scapula between angles $11\frac{3}{4}$ inches, glenoido-vertebral $8\frac{7}{8}$ inches, not strongly falciform, prespinous somewhat larger than postspinous fossa. Humerus $10\frac{1}{4}$ inches long, no supracondyloid foramen, radius $9\frac{1}{2}$ inches, ulna 11 inches long. Manus, radiale

and intermedium fused, ulnare, pisiform, four distal carpalia; pentadactylous, diminishing in length from pollex to minimus. Pelvic bone $12\frac{1}{2}$ inches long, iliac crest in almost same plane as base of sacrum. Femur $6\frac{3}{4}$ inches long, tibia $13\frac{3}{10}$ inches, fibula fused at upper end, $13\frac{1}{4}$ inches. Pes pentadactylous, hallux and minimus the longest; the customary seven tarsal bones. Skull $15\frac{1}{2}$ inches long, over vertex $21\frac{1}{4}$ inches; zygomatic breadth 11 inches, cranial between squamous sutures $7\frac{1}{4}$ inches; width of anterior nares $3\frac{1}{4}$ inches, sagittal length $4\frac{3}{4}$ inches; hard palate 7 inches long, $4\frac{8}{10}$ inches wide; mandible $10\frac{1}{4}$ inches long. Teeth with relatively small crowns, no secondary cusps; p.c. $\frac{5}{5} \frac{5}{5}$. Challenger Collection.

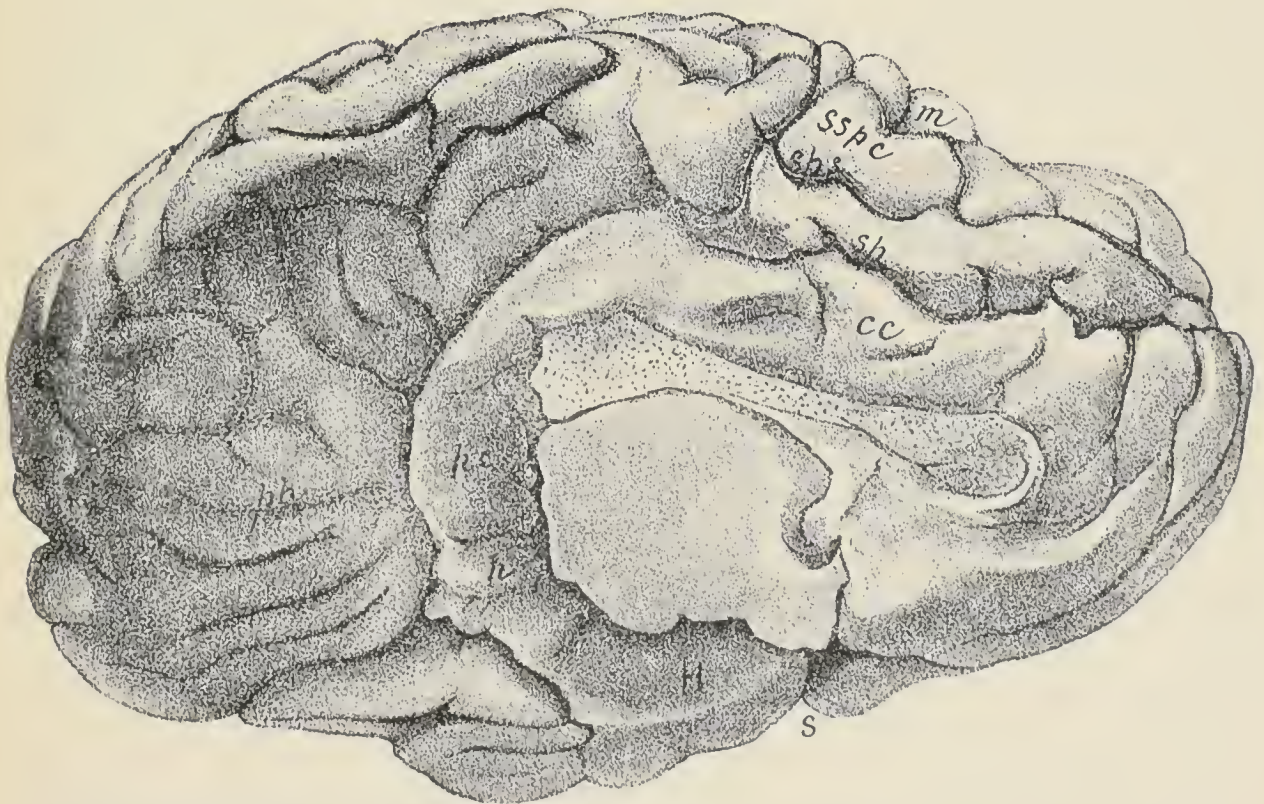
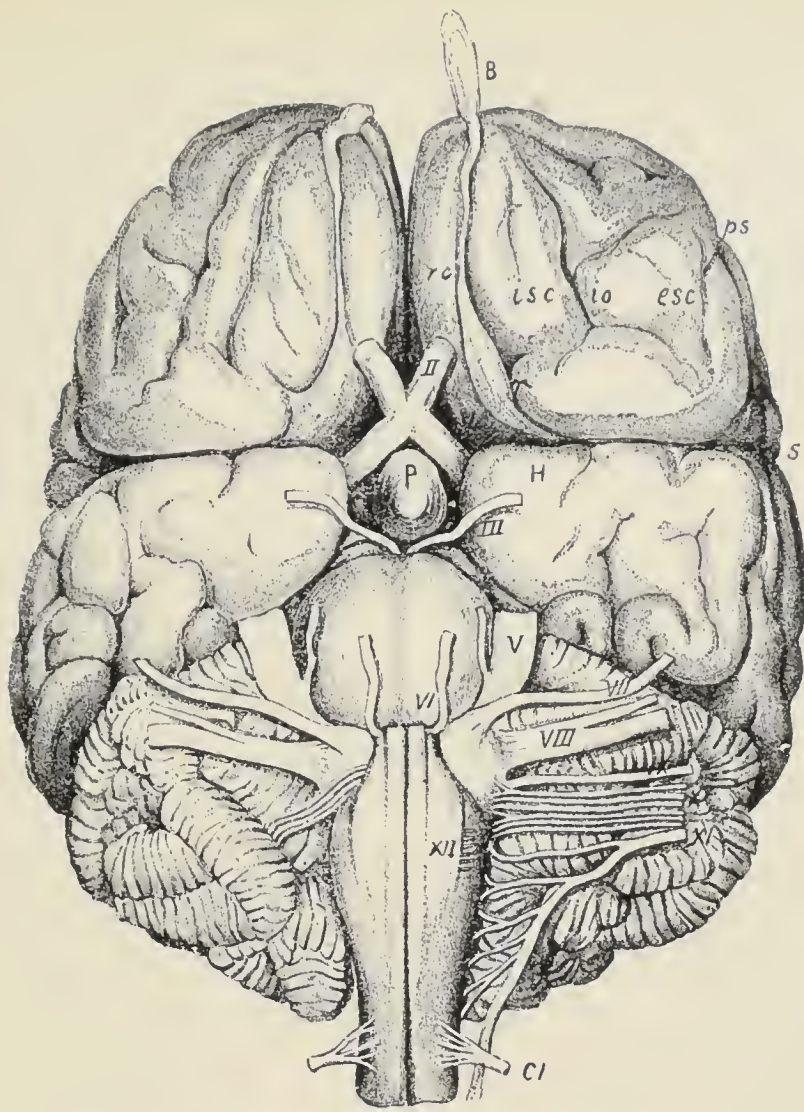
3. **Skull** and five Cervical Vertebrae of a large female (*f*) from Betsy Cove, Kerguelen. Basi-cranial joint nearly closed. Skull, length $11\frac{3}{4}$ inches, over vertex $16\frac{1}{2}$ inches; breadth, zygomatic $8\frac{3}{4}$ inches, cranial 7 inches; width of anterior nares 2 inches, sagittal diameter $3\frac{1}{8}$ inches; hard palate, length 5 inches, greatest width $3\frac{3}{8}$ inches. Mandible, length $7\frac{1}{2}$ inches. Crowns of teeth small, no secondary cusps; p.c. $\frac{5}{5} \frac{5}{5}$. Vertebrae, atlas, axis, 3rd, 4th, and 5th, plates not fused with bodies. Challenger Collection.

4. **Skull**, adult, male. Length $19\frac{1}{4}$ inches, over vertex 25 inches; breadth, zygomatic $13\frac{7}{8}$ inches, cranial at squamous sutures $8\frac{3}{8}$ inches: length of hard palate $9\frac{3}{4}$ inches; greatest width of anterior nares 4 inches. Mandible, length $13\frac{1}{2}$ inches. Dentition: p.c. $\frac{4}{4} \frac{4}{4}$. Cranial crests as in No. 1. See *Challenger Report*, in which, in error, the skull is said to have been obtained in Heard Island.

Macquarrie Island.

Donor—Dr J. Halliday Scott, Dunedin, N.Z.

5. **Skull** of young female from which the brain had been removed (*d* in *Challenger Report*). Length in straight line 11 inches, over vertex $14\frac{1}{2}$ inches. Breadth, zygomatic $7\frac{1}{8}$ inches, cranial $6\frac{3}{8}$ inches. Mandible length $6\frac{7}{8}$ inches, of symphysis $2\frac{1}{4}$ inches. Anterior nares, sagittal diameter $2\frac{3}{4}$ inches, transverse $1\frac{3}{4}$ inch. Christmas Harbour, Kerguelen, January 1874. Challenger Collection.



The base of the brain is shown in the upper figure. The numerals indicate the cranial nerves. CI, the 1st cervical; P, pituitary body; H, lobus hippocampi; S, Sylvian fissure; B, olfactory bulb; the small letters the convolutions of the orbital lobe.

The mesial surface of the left hemisphere in the lower figure. S, the Sylvian fissure; H, lobus hippocampi; *h*, hippocampal fissure; *ph*, postero-horizontal fissure; *sp*, splenial fissure; *cc*, convolution of corpus callosum; *sspc*, supra-splenial convolution; *m*, marginal convolution; *spe*, splenial convolution; *hc*, hippocampal convolution.

6. **Brain** of young female Elephant Seal, No. 5, from Christmas Harbour. Membranes removed. Its dimensions and anatomical characters are described by Turner in *Challenger Report*, lxviii., 1888, plates viii., ix. Figures on page 197.

Subfamily OGMORHININÆ.

Anterior nares in front of infra-orbital foramina, which open into floor of orbit; beak moderately prolonged in front of nares. Inner wall of orbit defective. Pterygoids almost horizontal, separated from base of skull by a slit or foramen. Dentition: in. $\frac{2}{2} \frac{2}{2}$,
 c. $\frac{1}{1} \frac{1}{1}$, p.c. $\frac{5}{5} \frac{5}{5} = 32$; post-canines two-rooted, except the first. First and fifth toes of pes longer than the others.

I. OGMORHINUS. (Og.)

Ogmorhinus, *Peters, Monatsb. d. k. preuss. Akad. d. Wiss., Berlin*, 1875.

Sténorhinque, *F. Cuvier, Mém. du Muséum*, xi., 1824.

Premaxillæ not quite reaching the nasals; cranial breadth may or may not be wider than interzygomatic; anterior nares oblique; inter-orbital part of frontal constricted behind, expanded anteriorly; hard palate scooped out at posterior border, vomer distinct in mid-palatal cleft; basioccipital not perforated; par-occipital process present. Wall of auditory meatus short; groove between tympanic and mastoid temporal. The name Stenorhynchus was originally given to this genus, but as it had been previously applied to a Crustacean, Ogmorhinus has been substituted.

(1) OGMORHINUS LEPTONYX. (OG. L.)

(Leopard Seal, Southern Ocean.)

Phoca leptonyx, *De Blainville, Journ. de Phys.*, xci., 1820.

Stenorhynchus leptonyx, *F. Cuvier, Dict. Sc. Nat.*, xxxix.: *Gray, Zool. Voy. Erebus and Terror*, 1875.

Tympanic bulla triangular, with pointed antero-internal apex, not much swollen, with ridge running from

base to apex. Post-canines with three pointed cusps; the middle the largest and recurved at the tip, the smaller inclined towards the middle. Superior maxilla with extensive articulation with nasal.

1. **Skull.** Length $12\frac{3}{4}$ inches, over vertex $15\frac{1}{4}$ inches; breadth, zygomatic $6\frac{1}{4}$ inches, cranial $5\frac{1}{8}$ inches. Mandible, length $9\frac{1}{4}$ inches; characters as in No. 1. See Turner in *Challenger Report* on Seals.

Wellington Harbour, New Zealand.

Donor—Sir James Hector, K.C.M.G.

2. **Skeleton**, disarticulated, adult male. Length something more than 8 feet. Vertebral formula $C_7D_{15}L_5S_3Cd_8$, imperfect. Fifteen pairs of ribs. Scapula plate-like; post-spinous a third larger than pre-spinous; axillary border falcate, acromion rudimentary, coracoid a tubercle; length between angles $10\frac{1}{4}$ inches, glenoido-vertebral 8 inches. Humerus $6\frac{7}{8}$ inches; no supra-condyloid foramen. Length of ulna $7\frac{1}{4}$ inches, radius $6\frac{1}{2}$ inches. Pelvic bone $8\frac{1}{4}$ inches long, iliac crest scarcely everted; femur $5\frac{1}{4}$ inches long; tibia and fibula fused at upper end, length of each 10 inches; sternum incomplete. Skull, length $15\frac{1}{2}$ inches, over vertex $18\frac{1}{2}$ inches; breadth, zygomatic $8\frac{3}{8}$ inches, cranial $5\frac{1}{2}$ inches. Mandible 12 inches long, thick, elongated, not everted, no angle.

From Scottish National Antarctic Expedition.

Donor—Dr W. S. Bruce.

(2) OGMORHINUS CARCINOPHAGUS. (OG. C.)

(Crab-eating or Saw-toothed Seal, Southern and Antarctic Oceans.)

Phoca carcinophaga, *Hombroun and Jacquinet, Voy. Pole Sud, Atlas, Mam.*, 1842, 1853.

Lobodon carcinophaga, *Gray, Zool. Voy. Erebus and Terror*, 1844.

Stenorhynchus serripes, *Owen, Ann. Mag. Nat. Hist.*, 1843.

Superior maxilla with limited articulation to nasal. Post-canines much longer than in *leptonyx*, one cusp recurved, elongated, somewhat bulbous at apex, with a small cusp in front, and one, two, or three behind. Mandible with distinct angle and rudimentary sub-condyloid process, symphysis greatly elongated. Skull not so elongated as in *leptonyx*.

1. **Skull**, with mandible, adult. Length in straight line 12 inches, over vertex $14\frac{1}{4}$ inches. Breadth, zygomatic $6\frac{1}{10}$ inches, cranial $5\frac{1}{10}$ inches. Anterior nares, greatest width $1\frac{3}{4}$ inch, sagittal diameter $3\frac{1}{8}$ inches. Nasals fused mesially into a triangular plate with base in front; premaxillæ reach nasals. Hard palate with markedly concave posterior border, mesial length $5\frac{1}{4}$ inches. Mandible $7\frac{1}{2}$ inches long, angle distinct, symphysis $2\frac{7}{8}$ inches long. Teeth characteristically cusped.

From the Scottish National Antarctic Expedition.

Donor—Dr W. S. Bruce.

II. LEPTONYCHOTES. (Lep.)

Leptonychotes, *Gill, Proc. Essex Inst.*, x., 1866.

Premaxillæ articulating with nasals; cranial breadth more than interzygomatic; anterior nares oblique; inter-orbital part of frontal long, constricted behind, broader anteriorly; superior maxillæ with moderate articulation with nasals. Hard palate scooped out at posterior border. No post-orbital process; hamular and pterygoid horizontal, everted; tympanic bulla swollen, not ridged, its anterior border truncated. Humerus without supracondyloid foramen. Dentition: in. $\frac{2}{2}$ $\frac{2}{2}$, c. $\frac{1}{1}$ $\frac{1}{1}$, p.c. $\frac{5}{5}$ $\frac{5}{5}$. Post-canines two-fanged except the most anterior, crowns with one large cusp.

(1) LEPTONYCHOTES WEDDELLI. (LEP. W.)

(Weddell's Seal, Southern Ocean.)

(The only species.)

Otaria weddelli, *Lesson, Ferrussac, Bull. Sci. Nat.*, vii, 1826.

Leptonyx weddelli, *Gray, Zool. Voy. Erebus and Terror*, 1844.

Leptonychotes weddelli, *Gill, op. cit.*

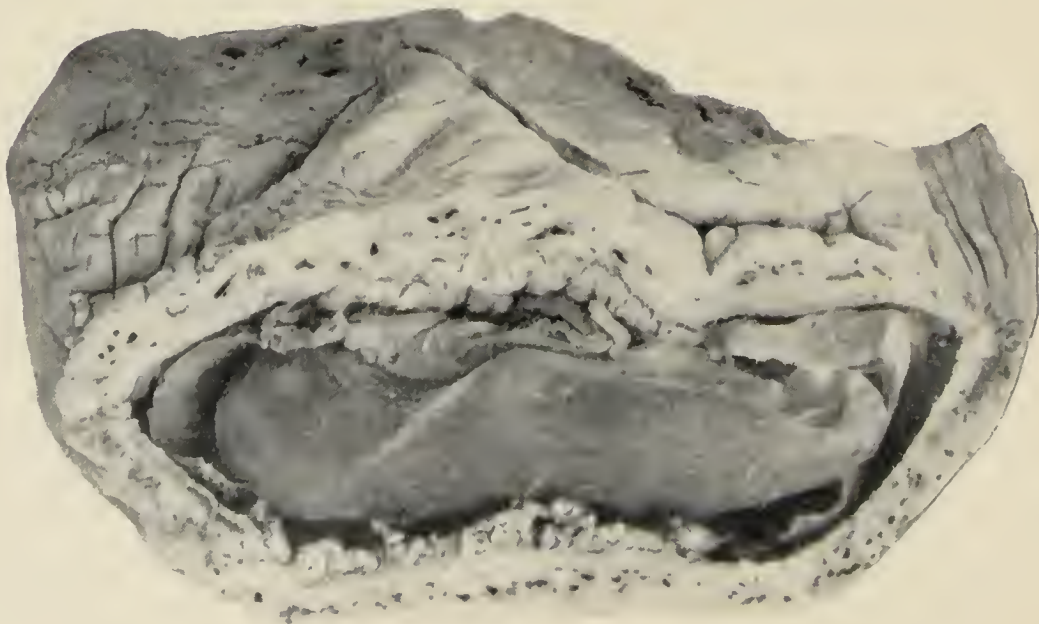
The skull and other bones of the skeleton of Weddell's Seal were described and figured by Turner in the *Challenger Report, Zoology*, part lxviii., 1887, and the characters of the skull were compared with those of *Stenorhynchus (Ogmorhinus) leptonyx*. Subsequently Dr David Hepburn has described in *Trans. Roy. Soc. Edin.*, vol. xlvii., 1909–1912, the viscera of Weddell's Seal, from a young male $51\frac{1}{2}$ inches long, obtained by the Scottish National Antarctic Expedition.

1. **Skeleton** of a Weddell's Seal from Betsy Cove, Kerguelen, in 1874. The vertebral plates and the epiphyses of the long bones not fused. Length of skeleton 5 feet 9 inches. Vertebral formula $C_7D_{15}L_5S_2Cd_{11} = 40$. Ribs, fifteen pairs, of which ten articulated with side of sternum, which was $18\frac{1}{2}$ inches long and consisted of ten segments. Scapula $4\frac{1}{2}$ inches between angles, glenoido-vertebral $4\frac{5}{8}$ inches, with pre- and post-spinous fossæ almost equal; coracoid and acromion feeble. Humerus without supracondyloid foramen $4\frac{1}{2}$ inches long; radius 5 inches; ulna $5\frac{3}{10}$ inches. Manus pentadactylous, radiale and intermedium fused, ulnare, pisiform, four distal carpalia. Pelvic bone $7\frac{1}{2}$ inches long, ilium with upper end in almost the same plane as base of sacrum; femur $3\frac{3}{4}$ inches long; tibia 8 inches; fibula about the same; pes pentadactylous, hallux and minimus the longest toes, tarsus, with astragalus, calcis, scaphoid, cuboid, three cuneiform. Skull $9\frac{3}{10}$ inches long, over vertex 12 inches; interzygomatic width $5\frac{6}{10}$ inches, cranial breadth $4\frac{5}{8}$ inches; greatest width of anterior nares $1\frac{1}{8}$ inch; hard palate $3\frac{1}{2}$ inches long by $2\frac{1}{4}$ wide; mandible $5\frac{3}{4}$ inches long. Challenger Collection.
2. **Skeleton** of a male collected by the Scottish National Antarctic Expedition, not adult, as the epiphyses were imperfectly fused with their bones. Length about 10 feet. Vertebral formula $C_7D_{15}L_5S_2Cd_{10} = 39$. Fifteen pairs of ribs. Sternum with eight segments present. Scapula plate-like; diameter between angles $7\frac{5}{8}$ inches, glenoido-vertebral $6\frac{1}{4}$ inches; pre- and post-spinous fossæ almost equal; acromion rudimentary; coracoid a tubercle; axillary border falcate. Humerus imperfect; radius and ulna with lower epiphyses not united. Pelvic bone $10\frac{1}{4}$ inches long; iliac crest a little everted. Femur 5 inches long; upper and lower epiphyses almost fused. Tibia and fibula fused at upper end; lower epiphyses not fused with shafts. Tarsalia, seven bones. Skull, length $10\frac{3}{4}$ inches, over vertex $13\frac{1}{2}$ inches; breadth, zygomatic $6\frac{3}{4}$ inches, cranial $4\frac{3}{4}$ inches. Mandible, length $6\frac{3}{4}$ inches; subcondylar process a small tubercle, slightly inverted, no angle. Donor—Dr W. S. Bruce.
3. **Uterus**, two-horned. Corpus uteri $4\frac{3}{4}$ inches long; the cornua curve forwards and outwards for between 7 and 8 inches, the girth of each cornu where it

springs from the corpus is between 4 and 5 inches. A section was made through the wall of the left cornu; the muscular coat is thick and tough and contained numerous vessels; the mucous lining is distinct with strong folds, the cavity is occupied with inspissated mucus. The Fallopian tube is much convoluted, and in the peritoneal fold immediately below it the ovary, the size of a large walnut, is situated. A section was made through the substance of the ovary, and many Graafian follicles were exposed. The vagina had been cut across close to the uterus, and the cervix and os uteri externum are displayed. From the Scottish National Antarctic Expedition.

Donor—Dr W. S. Bruce.

4. **Uterus**, gravid, with a foetus in the left cornu, which had been detached from the corpus uteri; the cornu is $4\frac{1}{2}$ inches long. A portion of the wall had been removed and the cavity and contents exposed. The cavity is $3\frac{5}{8}$ inches long and $1\frac{1}{8}$ inch in greatest width. It communicated at one end with the canal in the body of the uterus, and by the other with the Fallopian tube. A foetus was exposed enveloped by the amnion; it is 3 inches long and extended; the head points to the opening into the body of the uterus, the tail is close to the Fallopian tube. The chorion occupies the cavity close to the uterine wall and stretches between the two openings; a limited extent of the free surface at the poles of the chorion near these openings is free, smooth, and non-villous; the intermediate part is thickened, fused with the uterine mucous membrane, and forms a zonary



placenta $2\frac{1}{4}$ inches broad. As the chorion had been divided in making the section through the wall of the cornu, the umbilical vessels can be seen entering the free surface of the placenta, which has a convoluted surface, such as I have described in the placenta of *Halichærus grypus*. The uterine wall, especially in the placental region, is very vascular, and the mucous membrane with which the non-villous chorion is in contact, is not absolutely smooth, but marked by very faint ridges, possibly due to the hardening action of the formalin in which the uterus had been preserved. The dissection was made by Dr David Waterston, and the figure is reproduced with his permission.

From the Scottish National Antarctic Expedition.

Donor—Dr W. S. Bruce.

5. **Penis** from another specimen, showing the part in relation to the investing integument $8\frac{1}{2}$ inches long, as well as the deeper end of the organ, 5 inches long. The glans is $5\frac{1}{2}$ inches long, measured along the curve. The meatus is distinct at the free end of the glans. From the Scottish National Antarctic Expedition.

Donor—Dr W. S. Bruce.

III. OMMATOPHOCA. (Om.)

Ommatophoca rossi, Gray, *Zool. Voy. Erebus and Terror*, 1844.

Premaxillæ do not reach nasals. Anterior nares almost in vertical plane. Nasals long, ankylosed. Orbits very large; inter-orbital part of frontal bone broad, not constricted behind. Malars greatly elongated; marked protuberance on squamous immediately behind zygoma. Hard palate slightly scooped, length and greatest breadth equal or almost equal. Tympanic bulla not much swollen, triangular, roughened, prolonged outwards into a strong process which forms the floor of external meatus extending beyond its opening. Basi-occipital not perforated. Pterygoids everted, oblique. Mandible with rough, inverted subcondyloid process, distinct from the moderate angle. Dentition: in. $\frac{2}{2}$ $\frac{2}{2}$, c. $\frac{1}{1}$ $\frac{1}{1}$, p.c. $\frac{5}{5}$ $\frac{5}{5}$; crowns of post-canines relatively small, one large cusp with two subordinate cusps, two-fanged except first.

(1) OMMATOPHOCA ROSSI. (OM. R.)

(Ross's Seal, Antarctic Ocean.)

(The only species.)

Ommatophoca rossii, Gray, *Zool. Voy. Erebus and Terror*, 1844.

1. **Skeleton** of adult male, No. 43 in the collection of the Scottish National Antarctic Expedition. It is described by Dr Rt. B. Thomson in *Trans. Roy. Soc. Edin*, vol. xlvii., part i., 1909. The animal was captured in February 1904. Thomson gives the following dimensions:—Length 2 feet $11\frac{1}{4}$ inches, girth 1 foot $10\frac{1}{4}$ inches, weight 400 lbs. Vertebral formula $C_7D_{15}L_5S_3Cd_{10}=40$. Skull short and broad; length $9\frac{7}{8}$ inches, over vertex 12 inches; breadth, zygomatic $7\frac{1}{8}$ inches, cranial $4\frac{1}{2}$ inches. A persistent hole in region of anterior fontanelle, see figure below and figure 1 in Thomson's Memoir. Hard palate 3 inches long by 3 in greatest width. Mandible 7 inches long. Teeth feeble. Dr E. A. Wilson states that the food consists mainly of cephalopods (*Nat. Hist. of Antarctic Expedition*). Donor—Dr W. S. Bruce.



2. **Skull** of adult female, No. 2 of Scottish National Antarctic Expedition. Animal captured February 1903. See Thomson's memoir. Length 2 feet $11\frac{1}{2}$ inches, girth 1 foot $9\frac{1}{2}$ inches, weight between 450 and 500 lbs.

Cranium much injured. Hard palate, length $3\frac{1}{4}$ inches; greatest breadth, behind last post-canine, $2\frac{7}{8}$ inches. Mandible, length $6\frac{5}{8}$ inches.

Donor—Dr W. S. Bruce.

IV. MONACHUS. (Mon.)

Phoca monachus, Hermann, *Abth. Akad. Wiss. Berlin*, 1779.

Monachus, Fleming, *Philosophy of Zoology*, 1822.

Pelagius monachus, F. Cuvier, *Dict. Sci. Nat.*, 1829.

Anterior nares oblique. Hard palate slightly emarginate, posterior border behind maxillary root of zygomata and in front of glenoid fossa. Tympanic bulla swollen, scarcely ridged, apex truncated; basi-occipital perforated mesially, occipital condyls confluent. Dentition: in. $\frac{2}{2}$ $\frac{2}{2}$, c. $\frac{1}{1}$ $\frac{1}{1}$, p c. $\frac{5}{5}$ $\frac{5}{5}$ = 32.

Crowns of post-canines strong, conical, compressed, with faint accessory cusps. Vertebral formula $C_7D_{15}L_5S_2Cd_{11}=40$. Nails of manus and pes small and rudimentary.

(1) MONACHUS ALBIVENTER. (MON. AL.)

(Monk Seal, Mediterranean.)

(The only species.)

No specimen in Museum.

ADDENDA. (Add.)

1. **Skull** of an adult *Balæna biscayensis* with the upper jaw highly arched. Length, condylo-premaxillary, in straight line 13 feet 9 inches, over vertex 16 feet. Greatest transverse diameter 9 feet 4 inches. Occipital bone from foramen magnum to upper border 3 feet 9 inches, transverse diameter 3 feet 11 inches. Width of hard palate from mesial ridge to lateral border 15 inches on each side. Foramen magnum 6 inches in sagittal, and $5\frac{1}{2}$ inches in transverse diameter; width across condyls 17 inches. Mandible without coronoid process, length along outer curve 13 feet 6 inches; girth in front of condyl 3 feet 7 inches. Male, length of animal 51 feet, girth 32 feet. Caught 29th June 1912, 20 miles N.E. of St Kilda, by the whaler "Sir Samuel Scott."

Donor, 1912—Mr Carl F. Herlofson, Tarbert, Harris.

2. **Tympano-periotic** bones from the above skull. Right tympanic $5\frac{5}{8}$ inches long, $3\frac{1}{2}$ broad, $4\frac{3}{8}$ inches high; characters of tympanic and periotic as in No. 1, page 30. Malleus and incus *in situ*.
3. **Heart** and Great Vessels of *Grampus griseus*. The heart, as is customary in the Cetacea, is wide, $7\frac{3}{8}$ inches, in relation to its vertical diameter, which is only $4\frac{1}{4}$ inches; the width greatly preponderates over the height, and the apex is rounded. The trunk of the pulmonary artery passes almost horizontally to the left, and divides into right and left branches; the ductus arteriosus joins the descending part of the arch of the aorta. The aorta arches to the left and gives origin, close to the junction of the ascending and transverse parts, to a right and a left innominate artery.
4. **Tympanic Bulla**. Fibro-mucous membrane which formed the pouch-like lining of the bulla of a whale. The

species is uncertain, but from its resemblance in form to the pouch figured on page 86, it was probably *Hyperoodon rostratus*.

5. **Umbilical Cord**, portion of, from a Fin Whale, *Balenoptera*, sp.? dried. It is 2 feet long, and shows the spiral twisting of the umbilical arteries and veins. The whale was caught at New Island, Falkland Isles, May 1911. Donor—Mr G. Millen Coughtrey, 1912.
6. **Lance**, at one time used in the Whale fishery, 9 feet long, the iron terminal part being 6 feet.
Donor—Wm. Boyd, Esq., Peterhead.
7. **Hand Harpoon**, at one time used in the Whale fishery, 9 feet long, the iron part being 2 feet 3 inches in length.
Donor—Wm. Boyd, Esq.
8. **Gun Harpoon** 3 feet 2 inches long.
Donor—Wm. Boyd, Esq.



